HEWLETT PACKARD

Diagnostic Configurator

Reference Manual

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The Printing History below identifies the Edition of this Manual and any Updates that are included. Periodically, Update packages are distributed which contain replacement pages to be merged into the manual, including an updated copy of this Printing History page. Also, the update may contain write-in instructions.

Each reprinting of this manual will incorporate all past Updates, however, no new information will be added. Thus, the reprinted copy will be identical in content to prior printings of the same edition with its user-inserted update information. New editions of this manual will contain new information, as well as all Updates.

To determine what manual edition and update is compatible with your current software revision code, refer to the appropriate Software Numbering Catalog, Software Product Catalog, or Diagnostic Configurator Manual.

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Chapter 1
Introduction

General

This manual describes the operation and use of the Diagnostic Configurator (hereafter called the Configurator), a standalone program loaded into an HP 1000 M-Series, E-Series, F-Series, 2100A/S, 2116A/B/C, 2115A, or 2114A/B Computer System* before other diagnostics. The program loads and controls the sequential execution of most of the HP 2100 Series Computer interface, and peripheral equipment diagnostics, and they in turn reference the Configurator for certain parameters required by the diagnostics.

The Configurator is available on all diagnostic media which include paper tape, HP 7900/7905/7906 Disc, HP 7970B/E Magnetic Tape, HP 2644/2645/48 Minicartridges and CS/80 Cartridge Tape.

The diagnostic media listed below include the diagnostic library on the specified medium and all associated manuals:

PRODUCT NO.	MEDIUM	COMMENT
24396A	Paper Tape	All configurator-compatible diagnostics on any medium
24396B	7900 Disc	
24396C	7905 Disc	
24396D	7970B Magnetic Tape	
24396E	7970E Magnetic Tape	
24396F	2644/45 Minicartridge	All configurator-compatible diagnostics on 7 cartridge tapes
24396H	CS/80 Cartridge Tape	

In addition to the products mentioned above which provide all configurator-compatible diagnostics on different media a special selection of diagnostics has been created. This selection (part no. 24998-14002) carries only the diagnostics which are compatible with the HP 1000 System.

* Throughout the rest of this manual, the term "2100 Series Computer" will be used as a general reference to any one of the above-mentioned computer systems. When specifically required, the term "21MX" will be used to specify a 21MX M-Series, E-Series, or 21MX F-Series Computer.

Two Diagnostic Reference Tables, which are provided in Appendix A, list the Diagnostic Serial Numbers (DSN), diagnostic designations, and the associated part numbers for the HP 2100 Series diagnostics and the appropriate manuals used with the Configurator.

Table A-1 lists all the diagnostics available on the media, Table A-2 lists the selected diagnostics for the HP 1000 System.

The Configurator furnishes drivers (console, line printer, and diagnostic input) and commonly used utility routines for the diagnostic program. It also sets parameters related to the computer which can be referenced by the executing diagnostic. This allows a diagnostic, in conjunction with the Configurator, to test an HP 2100 Series Computer, an interface board, or a peripheral subsystem connected to the computer.

The Configurator can be executed in three basic modes: Conversational, Automatic, and Manual. Other features in the Configurator include a pretest (for the CPU, memory, and basic I/O), Binary Loaders, Paper Tape Dump routine, and the ability to sequentially execute diagnostics (Long Diagnostic). The pretest is used when the CPU is in question and a check is desired prior to configurations. The Binary Loaders allow the operator to load diagnostics from any standard input device. (See the required hardware section of this chapter.) The Paper Tape Dump routine is used to dump (to paper tape) an absolute binary copy of the object code currently in memory. Sequential diagnostic execution capabilities are included to allow the operator to execute diagnostics in the Long Diagnostic mode from any one of the specified input devices.

It should be noted that previous diagnostics were coded for a particular computer system such as the diagnostics designed exclusively for the HP 2116 Computers. The Diagnostic Configurator is not compatible with these single computer diagnostics. However, it is possible to use the Teleprinter Driver portion of the Configurator in conjunction with previous diagnostics. Since, during the loading process, such a previous diagnostic will overlay portions of the Configurator, it is necessary to reload the Configurator when it is desired to run a newer type of diagnostic listed in Appendix A. Any programs loaded with the Configurator shall not overlay the linkage area except locations 100, 105, 116, and 126 (octal). (See Figure 3-2.)

Also included in this manual are the descriptions and procedures for storing the Configurator, diagnostics, and control programs on disc (Disc Initialization) and interconnecting two CPU's (Cross Link). The binary object programs are separated from the Configurator and have their own DSN's. They must be loaded prior to execution. Disc Initialization and Cross Link are covered in Appendix C.

Required Hardware

The following hardware is required:

a. An HP 2100 Series Computer with at least 4K of memory. When a computer has more than 4K of memory, the Configurator utility routines and device drivers are relocated to the last page of memory. See Configurator Limitations in this chapter, and Configurator Binary Loader in Chapter 2, for memory size restrictions. The computer must have the configured basic binary loader (BBL), for the medium on which the Configurator is stored, in the last 64 (decimal) locations in memory. (Refer to Appendix E.)

b. A loading device for the medium on which the Configurator is stored. (Normally this is the same as the diagnostic input device.)

c. A console device, for operator communication, is optional. If a console is used, the interface must be an HP 12531B/C/D, HP 12880A, HP 12587B, HP 12966A or HP 12968A.

d. A diagnostic input device. (The device for loading depends upon the medium on which the Configurator/diagnostic(s) are distributed or available.)

1.	Paper tape reader:	HP 2737A/B, HP 2748A/B, HP 2758A (or teleprinter with paper tape reader).
2.	Magnetic tape unit:	HP 7970B/E (9-track only, unit 0 only); requires DMA (DCPC).
3.	Cartridge disc:	HP 7900A or HP 7901A (unit 0, removable platter only); requires DMA (DCPC).
4.	Cartridge disc:	HP 7905A (unit 0, removable platter and upper surface only) or 7920A (unit 0, upper surface only; requires DMA (DCPC). The disc can only be interconnected to those computers specified in the appropriate hardware manuals.
5.	Minicartridge:	HP 2644A or 2645A Terminal; requires HP 12966A interface (strapped for external baud rate). (Operator must preselect left/right CTU. Refer to Owner's Manual, part no. 02644-90001 or 02645-90001.)
6.	CS/80 Cartridge Tape:	HP 7911/12/14 disc drive with integrated cartridge tape drive or HP 9144 stand alone cartridge tape drive.

Text Conventions Used

All halt codes, select codes, and addresses used in this manual are in octal unless specifically shown otherwise. Whenever the term "Press PRESET" is used in this manual it implies, in case of an HP 2100A/S, that "INTERNAL PRESET" has to be pressed. Throughout the flowcharts, notes, and text that follow, abbreviations may be used where necessary to conserve space and reduce confusion. The abbreviations used are listed below. (Such abbreviations as BBL, IBL, I/O, etc., are commonplace in HP 2100 Series Computer manuals and are not listed here.)

ABBREVIATION	MEANING
ADDR	Address
A-REG	A-Register
BMDL	Binary Moving Head Disc Loader
B-REG	B-Register
CART. DISC	Cartridge Disc
CR	Carriage Return
CTU	Cartridge Tape Unit
DC	Date Code
DCPC	Dual Channel Port Controller
DIAG	Diagnostic
DMA	Direct Memory Access
DRT	Diagnostic Reference Table
DSN	Diagnostic Serial Number
ENBL	Enable
EOF	End-of-File
EOM	End-of-Message
E-REG	E-Register
FWA	First Word of Available Memory
HLT(S)	Halt or halts
LF	Line Feed
LWA	Last Word of Available Memory
MAG TAPE	Magnetic Tape
MPRT	Memory Protect
M-REG	M-Register
P-REG	P-Register
REV.	Revision
RTE	Real-Time Executive
SC	Select Code
S-REG	Switch Register (or Display Register)
T-REG	T-Register (or Memory Data Register)
WCS	Writable Control Store

Configurator Limitations

If a diagnostic, which relocates the Configurator to a different area in memory, is executed and then aborted, the restart procedures as outlined in Chapter 2 and Figure 2-7 cannot be employed. The Configurator has to be reloaded with the binary loader and configured to continue with the execution of other diagnostics.

It is not advisable to utilize a diagnostic input device which has write capabilities (disc, magnetic tape, cartridge tape) if the functional integrity of the hardware is in question.

Due to the fact that A-, B- and P-Register on the HP 2114A/B computer can only be accessed via the Switch Register, it is mandatory that the A-, B-, P- and S-Registers be addressed in this sequence whenever the Configurator procedure calls for updating or modifying a register. Whenever the A- and/or B-Register are modified, the P- and S-Register contents have to be restored.

On an HP 2115A/B or HP 2166A/B/C Computer, the A-, B- and P-Registers can be modified in any sequence; however, the S-Register must be the last one set.

The FPP/SIS/FFP Diagnostic (DSN 101121) cannot be executed in the automatic sequential load manner. The DSN must be specified in the A-Register, and the diagnostic selection in the B-Register with bit 15 of the S-Register set.

The minimum memory size required is 4K. If the diagnostic to be executed or dumped on paper tape requires more than 4K, the minimum memory size is determined by the diagnostic and listed in the appropriate Diagnostic Reference Manual and in Appendix A of this manual. Table A-1 lists software and manual part numbers of all diagnostics that run under control of the Configurator. If a diagnostic occupies any memory locations in the area N6300 through N6500 (N5500 through N6500 for a CS/80 device) and the diagnostic is loaded from a disc, the available memory size is insufficient. (N=0 for 4K, N=1 for 8K, N=2 for 12K, and N=3 for 16K. If more than 16K are available, this limitation cannot be reached with any diagnostics.) See also Chapter 2.

If the Writable Control Store (WCS) accessory is installed, it must be disconnected to run the pretest because it issues an STF instruction to all SC's. The same applies for all I/O related diagnostics which employ a basic I/O test.

If the 12979B Dual-Port I/O Extender is installed and pretest or any I/O related diagnostic is to be run, the extender should be "locked" to the port (either A or B) that the computer running the diagnostic is connected to.

Full system dedication is required during loading and configuring the Configurator. This also applies to all associated components of the diagnostic input device.

Chapter 2
Operating Procedures

Operational Overview

This section describes the procedures for loading the Configurator, executing the Pretest, configuring the Configurator, and loading the diagnostics. The operating procedures are shown in flowcharts with notes where necessary for clarification.

There are three procedures for configuring the program: Conversational, Automatic, and Manual. The Conversational method provides a means of configuring the program from the console with one input from the S-Register and utilizing the parameters calculated by the program. This method provides a means of configuring the program with one input from the S-Register (A- and B-Registers) and utilizing the parameters calculated by the program. The Manual method provides a means of configuring the program using the S-Register exclusively and allows modification of the parameters calculated by the program.

The Conversational or Manual methods of configuration must be used when a line printer is required by a diagnostic.

Prior to configuration, the operator may execute the Pretest to ensure that the basic instructions of the CPU can be executed and the drivers will be configured correctly.

A general loading procedure flowchart for the various devices and computers is furnished as a quick reference in Figure 2-1.

The basic configuration procedure is:

1. LOAD THE CONFIGURATOR PROGRAM (Figure 2-2).

NOTE

Immediately after loading the Configurator (a diagnostic or a control program), the Diagnostic Serial Number (DSN) which resides in memory location 126 (octal) may be checked for a match with the information shown in the left-hand column of Table A-1 in Appendix A of this manual.

2. SET P-REG TO:

   a. 2 ⟶ to execute the Pretest prior to configuration (Figure 2-3).

   b. 100 ⟶ to start configuration directly.

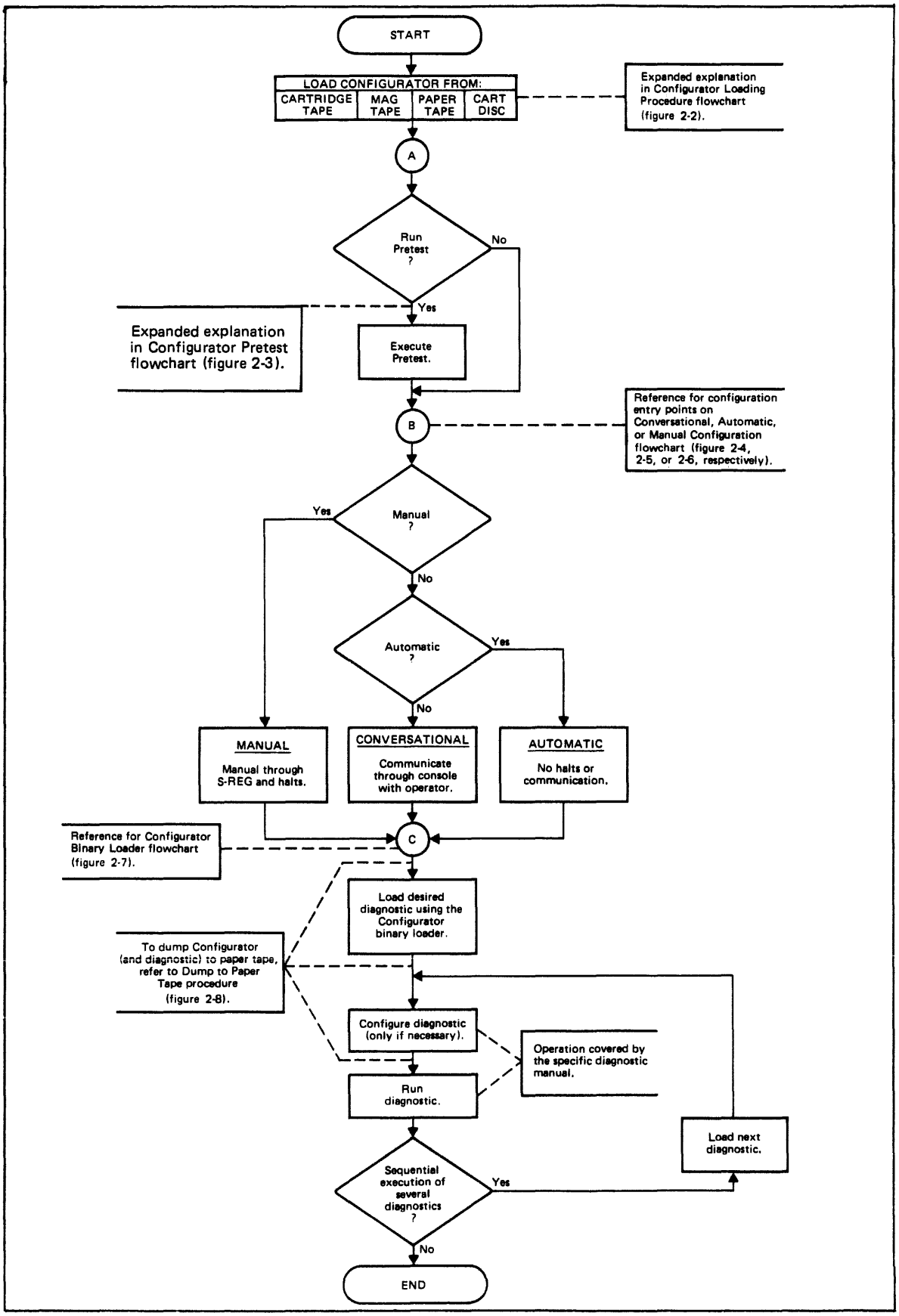


Figure 2-1. Operational Overview Flowchart

3. SET S-REG TO:

   a. The console select code (Conversational, Figure 2-4).

   - or -

   b. The console select code, diagnostic input device select code, and diagnostic input device type. Set bit 15 if the A-Register specifies a DSN and the B-Register the diagnostic to be loaded and executed following the specified DSN (Automatic, Figure 2-5).

   - or -

   c. Clear (Manual, Figure 2-6).

4. PRESS PRESET, RUN.

NOTE

Running time for the Configurator is entirely dependent upon the selection or deletion of the Pretest, the mode selected, and operator response time. (The Pretest requires approximately 10 seconds for a CPU with 32K of base memory.)

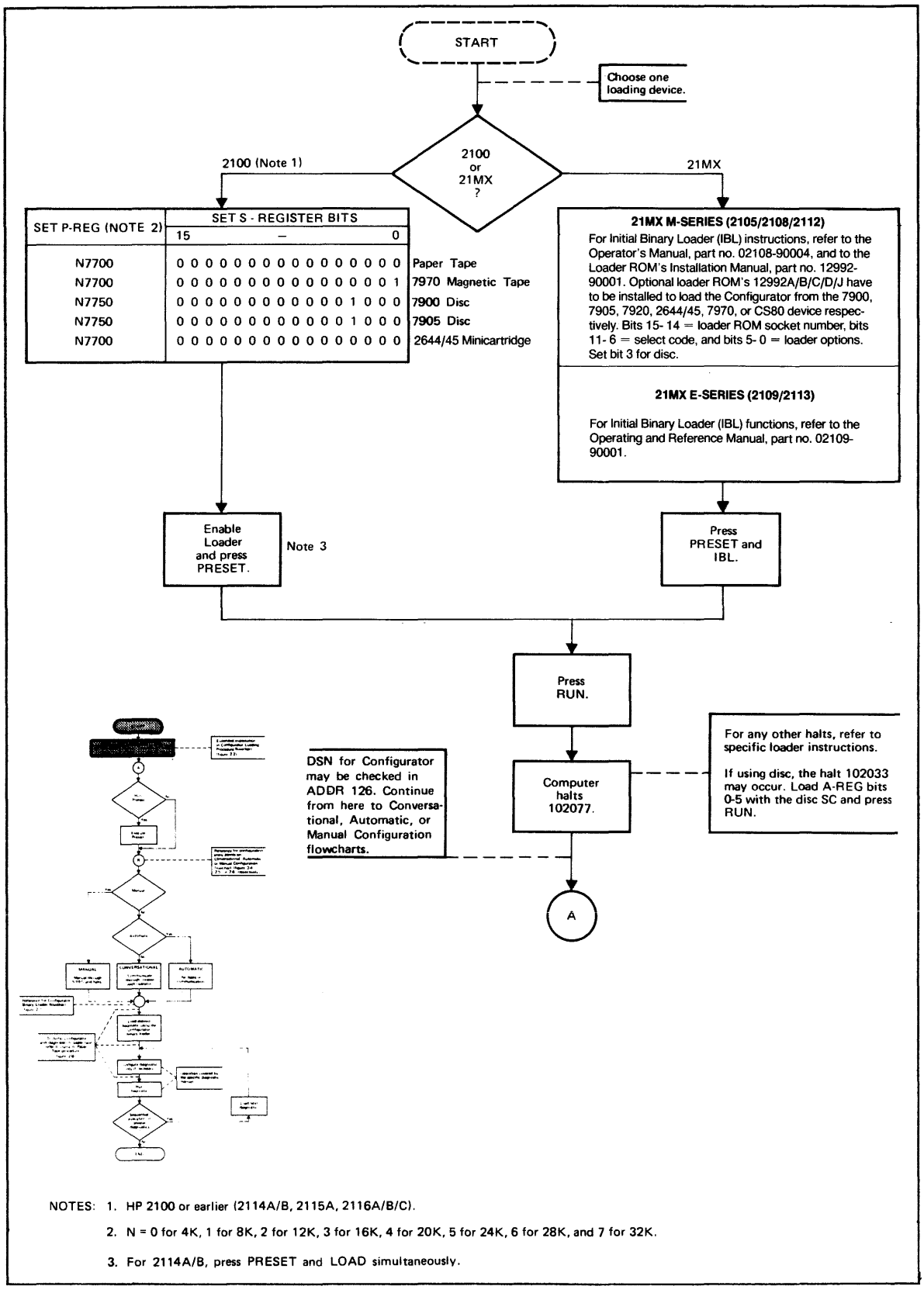
Configurator Loading Procedure

Figure 2-2 is the flowchart for loading diagnostics after the Configurator. The Configurator Binary Loader section of this chapter provides information for loading diagnostics after the Configurator is loaded and configured.

Register Usage

The following describes the use of the four registers (P, S, A and B) during configuration and the loading of diagnostics. The P-Register, as shown in the table below, shows the starting address of the various programs and the required registers.

P-REGISTER	PROGRAM SELECTION	REQUIRED REGISTERS
2	Execute Pretest	S-A-B
100	Configure Diagnostic Configurator	S-A-B
120	Load Diagnostics	A-B
N7677	Dump to Paper Tape	S


START
Choose one loading device.
2100 or 21MX ?
2100 (Note 1)
21MX
SET P-REG (NOTE 2)
SET S - REGISTER BITS
15 – 0
N7700 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 Paper Tape
N7700 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 7970 Magnetic Tape
N7750 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 7900 Disc
N7750 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 7905 Disc
N7700 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2644/45 Minicartridge
21MX M-SERIES (2105/2108/2112)
For Initial Binary Loader (IBL) instructions, refer to the Operator's Manual, part no. 02108-90004, and to the Loader ROM's Installation Manual, part no. 12992-90001. Optional loader ROM's 12992A/B/C/D/J have to be installed to load the Configurator from the 7900, 7905, 7920, 2644/45, 7970, or CS80 device respectively. Bits 15-14 = loader ROM socket number, bits 11-6 = select code, and bits 5-0 = loader options. Set bit 3 for disc.
21MX E-SERIES (2109/2113)
For Initial Binary Loader (IBL) functions, refer to the Operating and Reference Manual, part no. 02109-90001.
Enable Loader and press PRESET.
Note 3
Press PRESET and IBL.
Press RUN.
DSN for Configurator may be checked in ADDR 126. Continue from here to Conversational, Automatic, or Manual Configuration flowcharts.
Computer halts 102077.
For any other halts, refer to specific loader instructions.
If using disc, the halt 102033 may occur. Load A-REG bits 0-5 with the disc SC and press RUN.
A

NOTES: 1. HP 2100 or earlier (2114A/B, 2115A, 2116A/B/C).

2. N = 0 for 4K, 1 for 8K, 2 for 12K, 3 for 16K, 4 for 20K, 5 for 24K, 6 for 28K, and 7 for 32K.

3. For 2114A/B, press PRESET and LOAD simultaneously.

Figure 2-2. Configurator Loading Procedure Flowchart

S-Register

As shown in the table below, the S-Register is used to indicate which configuration mode (Automatic, Conversational, or Manual) shall be used. If only the console is specified, then Conversational is used. If the console and the input device are specified, then Automatic is used. If the S-Register is left clear, then Manual is used. If a legal but incorrect SC is given for an I/O device, the result is unpredictable.

During the Paper Tape Dump routine, the SC of the punch is specified in the S-Register. (Refer to Dump routine later in this chapter.)

S-REGISTER	PROGRAM SELECTION	DUMP ROUTINE
5-0	Console Select Code	Punch Select Code
11-6	Input Device Select Code	
14-12	Input Device Type	
15	Additional Parameters (in A- and B-Registers)	

A- and B-Registers

The two working registers have a special meaning when employed in conjunction with the Configurator Binary Loader. (See Table 2-1.)

The A-Register has to be either loaded with the DSN of the diagnostic to be read into memory (and executed) or be cleared, in which case the next sequentially stored file in the input device will be loaded (and executed).

The B-Register has to be loaded with the bit pattern representing the appropriate diagnostic files to be loaded (and executed) following the diagnostic specified by the A-Register. B-Register, bit 0 set, will call for the execution of the diagnostic specified by the A-Register, bit 1 set will call for the execution of the next sequential diagnostic (file), etc. If the B-Register is cleared, the diagnostic specified in the A-Register will be loaded but not automatically executed. If any bit or bits are set in the B-Register, it will load and start execution of the selected diagnostic.

If both the A- and B-Register are not clear the Configurator will, after the specified diagnostics have been executed, return (rewind) to the first diagnostic specified and repeat the execution; i.e., loop on selected diagnostics.

Table 2-1. Summary of A- and B-Register Concept

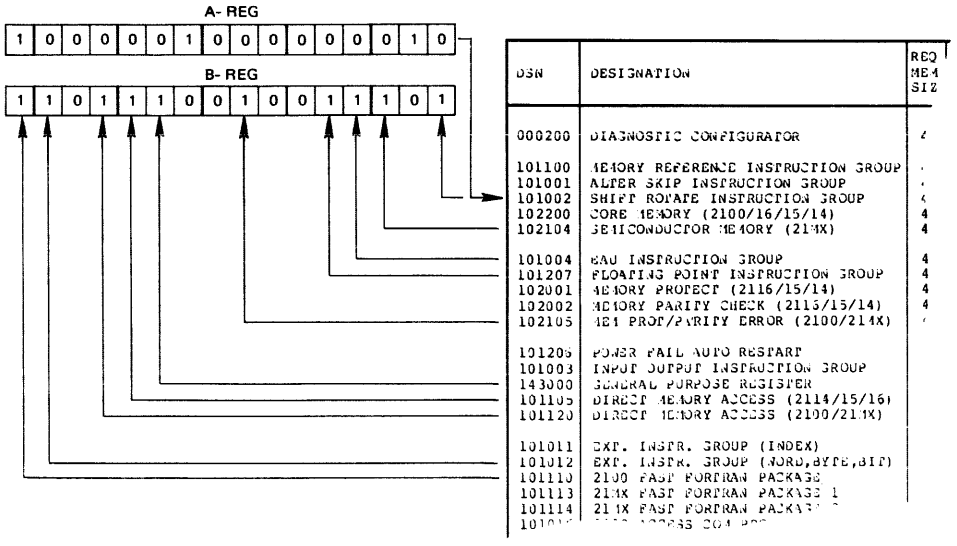
B-REGISTER	A-REGISTER	
	CLEARED	SET TO DSN
Cleared	Load next file (diagnostic) and halt before execution.	Load specified diagnostic and halt before execution.
Set to bit pattern	Load next file and execute from there on each diagnostic specified in the B-Register one time.	Load specified diagnostic, execute from there on each specified diagnostic, and loop on all selected diagnostics.

This concept enables the user to concatenate his own Long Diagnostic with the desired diagnostics. The A- and B-Registers are set prior to Automatic configuration (see the Automatic Configuration section of this chapter) and at the end of Manual configuration (halt 102077; see the Manual Configuration section of this chapter). In the Conversational mode, the user inputs the information via the terminal in response to the message: DSN (,SEQ.DIAG.EXECUT.)...

Example: A-REG ⟶ 101002: B-REG ⟶ 156235

A-REG ⟶ 101002: Load Shift-Rotate Instruction Group Diagnostic.

B-REG ⟶ 156235: Execute Shift-Rotate Instruction Group diagnostic, then load and execute sequentially the specified diagnostics.


A- REG
1 0 0 0 0 0 1 0 0 0 0 0 0 0 1 0
B- REG
1 1 0 1 1 1 0 0 1 0 0 1 1 1 0 1
DSN
DESIGNATION
REQ MEM SIZ
000200 DIAGNOSTIC CONFIGURATOR
101100 MEMORY REFERENCE INSTRUCTION GROUP
101001 ALTER SKIP INSTRUCTION GROUP
101002 SHIFT ROTATE INSTRUCTION GROUP
102200 CORE MEMORY (2100/16/15/14)
102104 SEMICONDUCTOR MEMORY (214X)
101004 EAU INSTRUCTION GROUP
101207 FLOATING POINT INSTRUCTION GROUP
102001 MEMORY PROTECT (2116/15/14)
102002 MEMORY PARITY CHECK (2115/15/14)
102105 MEM PROT/PARITY ERROR (2100/214X)
101206 POWER FAIL AUTO RESTART
101003 INPUT OUTPUT INSTRUCTION GROUP
143000 GENERAL PURPOSE REGISTER
101105 DIRECT MEMORY ACCESS (2114/15/16)
101120 DIRECT MEMORY ACCESS (2100/214X)
101011 EXT. INSTR. GROUP (INDEX)
101012 EXT. INSTR. GROUP (WORD,BYTE,BIT)
101110 2100 FAST FORTRAN PACKAGE
101113 214X FAST FORTRAN PACKAGE 1
101114 214X FAST FORTRAN PACKAGE

If in the above example the B-Register carries the value 156234, the Shift-Rotate Instruction Group diagnostic will not be executed.

After the 2100 Fast FORTRAN Package diagnostic has been executed and the diagnostic media is disc or magnetic tape, the diagnostic execution will restart. In case of cartridge tape or paper tape, an end-of-tape halt 106070 will be reached at an earlier point. This is because the cartridge tape number 1, with 17 files stored, reaches an EOF after the DMA/DCPC (2100/21MX) diagnostic. In case of paper tape, the first EOF will be reached after the semiconductor memory diagnostic.

Configurator Pretest

This procedure provides a means to execute the Pretest (which is loaded as part of the Configurator) prior to any configuration. It should be used whenever the CPU, memory, or basic I/O is in question. When it is executed and an error halt 102066 is encountered, the operator should refer to the listing in Appendix D. An error-reporting method via a console is employed for the Pretest because it verifies the basic integrity of the CPU, base memory, and basic I/O, which is a prerequisite for transferring data to a console. The approximate run time for the Pretest is 10 seconds for 32K of memory.

The memory section of the Pretest checks only the base memory. The basic I/O section of the Pretest requires a standard* I/O interface board with its SC specified. If installed, disconnect WCS accessory. The Configurator Pretest flowchart is shown in Figure 2-3.

Conversational Configuration

This procedure, which provides a fully conversational configuration from the console, must be used when a line printer is required.** It should also be used (if possible) when the operator is not familiar with the program operation. This procedure requires a console with one of the console interfaces listed in Chapter 1. The Conversational Configuration flowchart is shown in Figure 2-4.

All inputs are terminated by a CR (carriage return). If an entry is found incorrect prior to entering a CR, the input can be erased by entering a RUBOUT/DELETE. In reply, the program will issue a CR/LF (line feed).

* Standard I/O implies that the interface will respond to the assigned meaning of the I/O instructions and will also interrupt when control and flag are set and the interrupt system is enabled (e.g., the 12665-60001, 59310-60101, 13175A, and 13178B interfaces cannot be used).

** Manual method may also be used to specify (configure) a line printer driver.

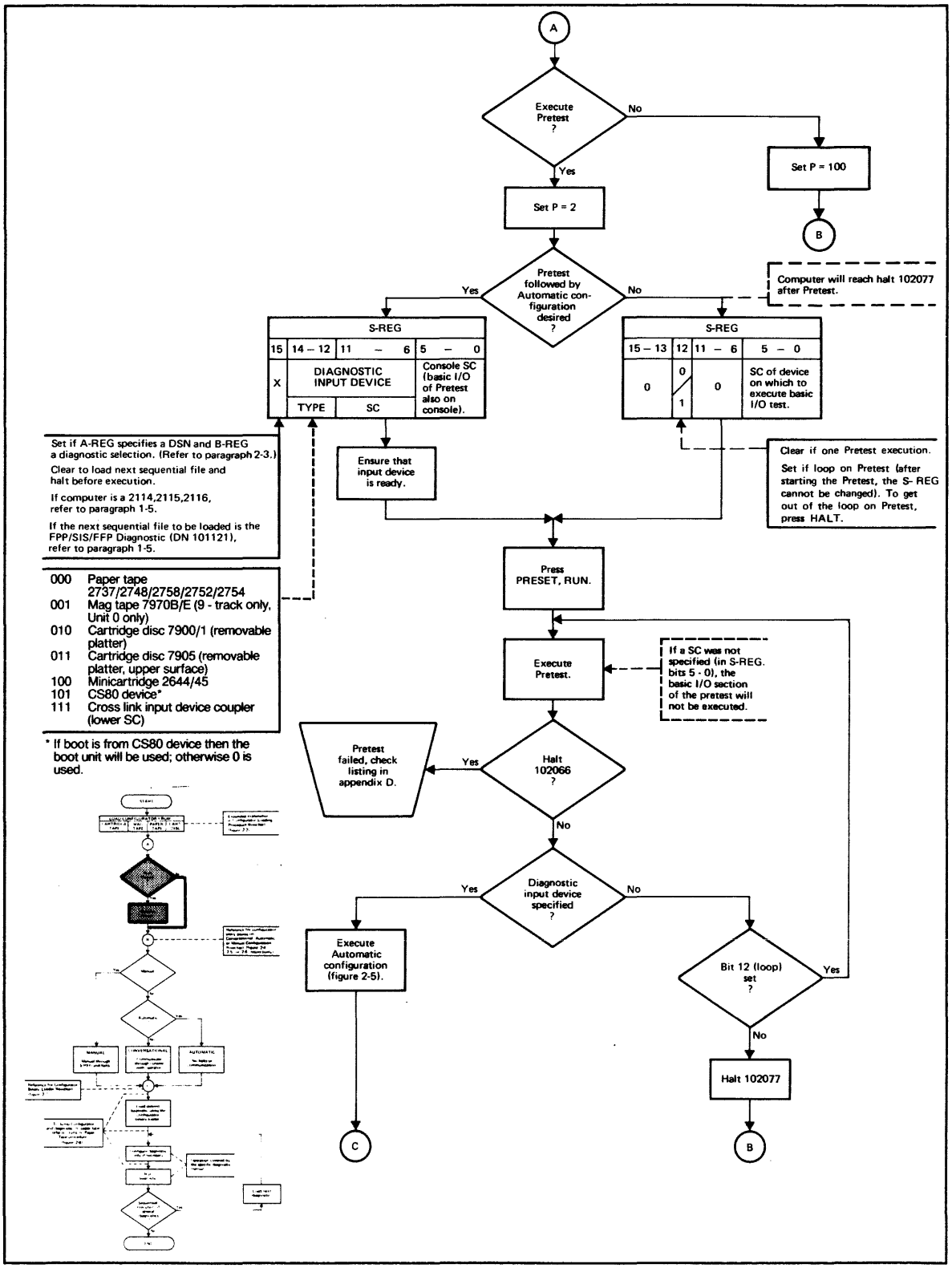
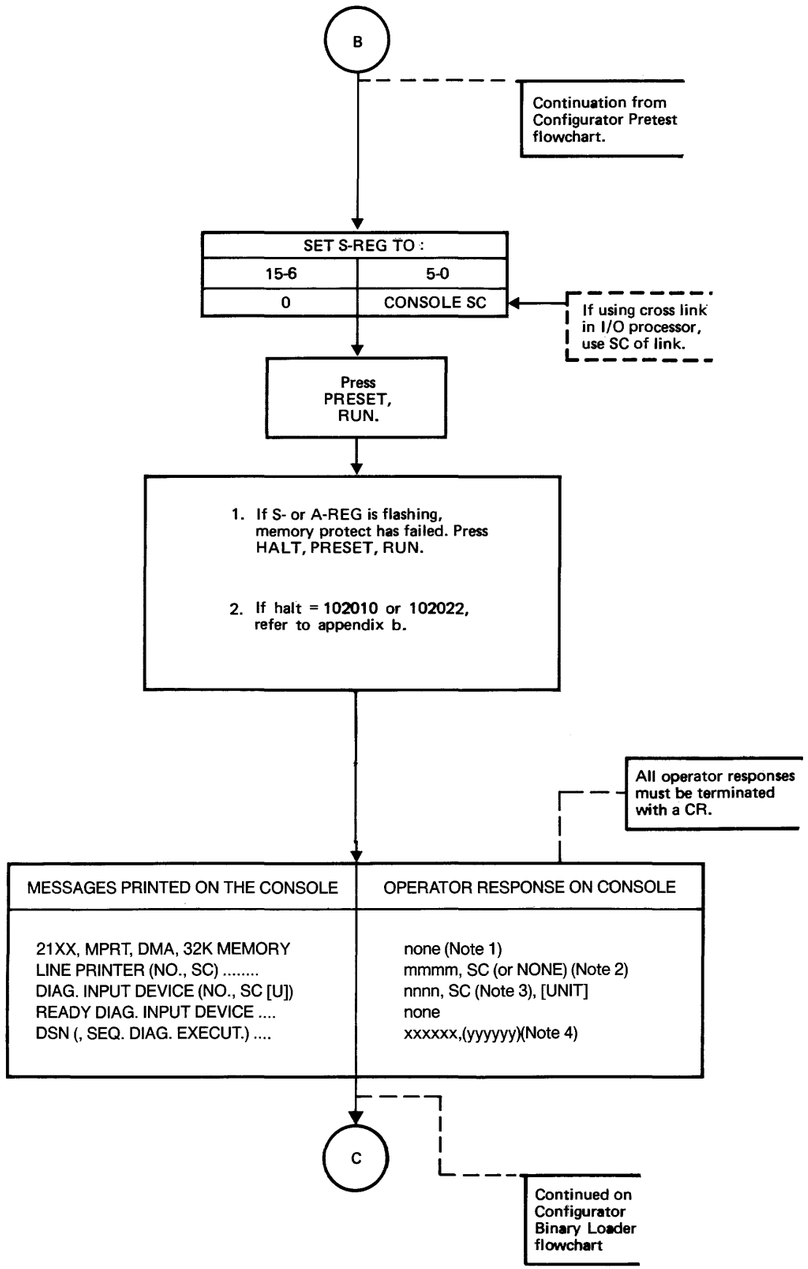

A
Execute Pretest ?
No
Yes
Set P = 100
B
Set P = 2
Pretest followed by Automatic configuration desired ?
Yes
No
Computer will reach halt 102077 after Pretest.
S-REG
15 | 14 – 12 | 11 – 6 | 5 – 0
X | DIAGNOSTIC INPUT DEVICE | | Console SC (basic I/O of Pretest also on console).
TYPE | SC
S-REG
15 – 13 | 12 | 11 – 6 | 5 – 0
0 | 0/1 | 0 | SC of device on which to execute basic I/O test.
Set if A-REG specifies a DSN and B-REG a diagnostic selection. (Refer to paragraph 2-3.)
Clear to load next sequential file and halt before execution.
If computer is a 2114,2115,2116, refer to paragraph 1-5.
If the next sequential file to be loaded is the FPP/SIS/FFP Diagnostic (DN 101121), refer to paragraph 1-5.
Ensure that input device is ready.
Clear if one Pretest execution.
Set if loop on Pretest (after starting the Pretest, the S- REG cannot be changed). To get out of the loop on Pretest, press HALT.
000 Paper tape 2737/2748/2758/2752/2754
001 Mag tape 7970B/E (9 - track only, Unit 0 only)
010 Cartridge disc 7900/1 (removable platter)
011 Cartridge disc 7905 (removable platter, upper surface)
100 Minicartridge 2644/45
101 CS80 device*
111 Cross link input device coupler (lower SC)
* If boot is from CS80 device then the boot unit will be used; otherwise 0 is used.
Press PRESET, RUN.
Execute Pretest.
If a SC was not specified (in S-REG. bits 5 - 0), the basic I/O section of the pretest will not be executed.
Pretest failed, check listing in appendix D.
Halt 102066 ?
Yes
No
Diagnostic input device specified ?
Yes
No
Execute Automatic configuration (figure 2-5).
Bit 12 (loop) set ?
Yes
No
Halt 102077
C
B

Figure 2-3. Configurator Pretest Flowchart


B
Continuation from Configurator Pretest flowchart.
SET S-REG TO :
15-6
5-0
0
CONSOLE SC
If using cross link in I/O processor, use SC of link.
Press PRESET, RUN.
1. If S- or A-REG is flashing, memory protect has failed. Press HALT, PRESET, RUN.
2. If halt = 102010 or 102022, refer to appendix b.
All operator responses must be terminated with a CR.
MESSAGES PRINTED ON THE CONSOLE
OPERATOR RESPONSE ON CONSOLE
21XX, MPRT, DMA, 32K MEMORY
none (Note 1)
LINE PRINTER (NO., SC) .....
mmmm, SC (or NONE) (Note 2)
DIAG. INPUT DEVICE (NO., SC [U])
nnnn, SC (Note 3), [UNIT]
READY DIAG. INPUT DEVICE ....
none
DSN (, SEQ. DIAG. EXECUT.) ....
xxxxxx,(yyyyyy)(Note 4)
C
Continued on Configurator Binary Loader flowchart

Console Configuration Notes:

1. No response to this message is required. The printout shows the parameters calculated by the program. They are listed for operator reference only. The actual printout will depend on the computer and its options:

21MX M, 21MX E, 2114, 2115, 2116, 2100	Computer type (21MX E refers to the E-Series and F-Series computer)
NO MPRT or MPRT	Memory protect
NO DMA or DMA	Direct Memory Access/Dual Channel Port Controller
32K MEMORY	Calculated base memory size, this does not include Memory Expansion Unit.

2. Respond with the appropriate line printer model number and select code.

mmmm	=	2767, 2610, 2614, 2613, 2617, 2618, 2778, 2607 or 9866 NONE (if not available) LINK (if cross link is used)
SC	=	Line printer select code.

3. Respond with the appropriate device number (or LINK) and select code.

nnnn	=	2737, 2748 or 2758	Paper tape devices
	=	7970	Mag tape (9 - track only, Unit 0 only)
	=	7900 or 7901	Cartridge disc (removable platter only)
	=	7905/20	Cartridge disc (removable platter, upper surface)
	=	2644 or 2645	Minicartridge (input 2645 if using 2648)
	=	LINK	(if cross link input device coupler is used)
SC	=	select code of device	(Lower SC in case of 2 SC)
UNIT	=	unit number	CS80 device (Default is 0)

4. Respond with the desired Diagnostic Serial Number for the indicated value of xxxxxx. Refer to appendix A for a list of available diagnostic and their DSN's. If 0 is entered, the next consecutive binary file will be loaded from the input device.

   The value yyyyyy may be entered for the octal equivalent of the binary bits selecting the desired diagnostic. (The program will load the values xxxxxx into the A- REG and yyyyyy into the B- REG and interpret as explained in paragraph 2-3.) If yyyyyy is not entered, the program sets the B- REG to 000000.

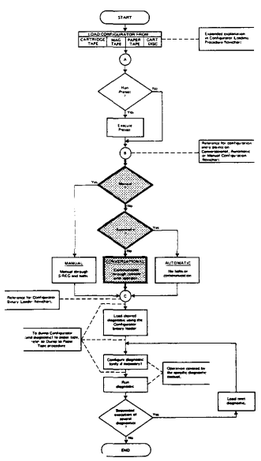


Figure 2-4. Conversational Config. Flowchart

Automatic Configuration

This procedure provides a means to configure the program and load a diagnostic with one input from the S-Register. There are no messages on the console. The program configures the appropriate drivers and then loads a diagnostic. Because there is no report of what is calculated by the program, the operator must assume that the calculations were made correctly. For Automatic Configuration, Figure 2-5 shows the expansion of point B to point C from the Operational Overview flowchart.

NOTE

Because there are no bits available in the S-Register to identify the unit numbers of a CS/80 device, the system tries to load the diagnostic from the boot unit. If the system was not booted using the CS/80 device, unit 0 is used. If you wish to load the diagnostic from another unit, use the Conversational or Manual configuration method.

Manual Configuration

This procedure allows complete configuration through the S-Register via five halts. The program calculated parameters are displayed in the A- and S-Registers at the appropriate halts (0 and 3). When the operator presses RUN, the S-Register is read and the information supersedes the calculated value.* The basic halts and required inputs are:

HALT	INPUT
102000	Computer type and options
102001	Console interface type and select code
102002	Line printer type and select code
102003	Memory size
102004	Diagnostic input device type, select code, and unit number
102077	Configuration complete

* After halt 102077, the program exits to the Configurator Binary Loader routine to accept a DSN in the A-Register and a sequential execution bit pattern in the B-Register. (Refer to the Register Usage section at the beginning of this chapter.) The Manual Configuration flowchart is shown in Figure 2-6.

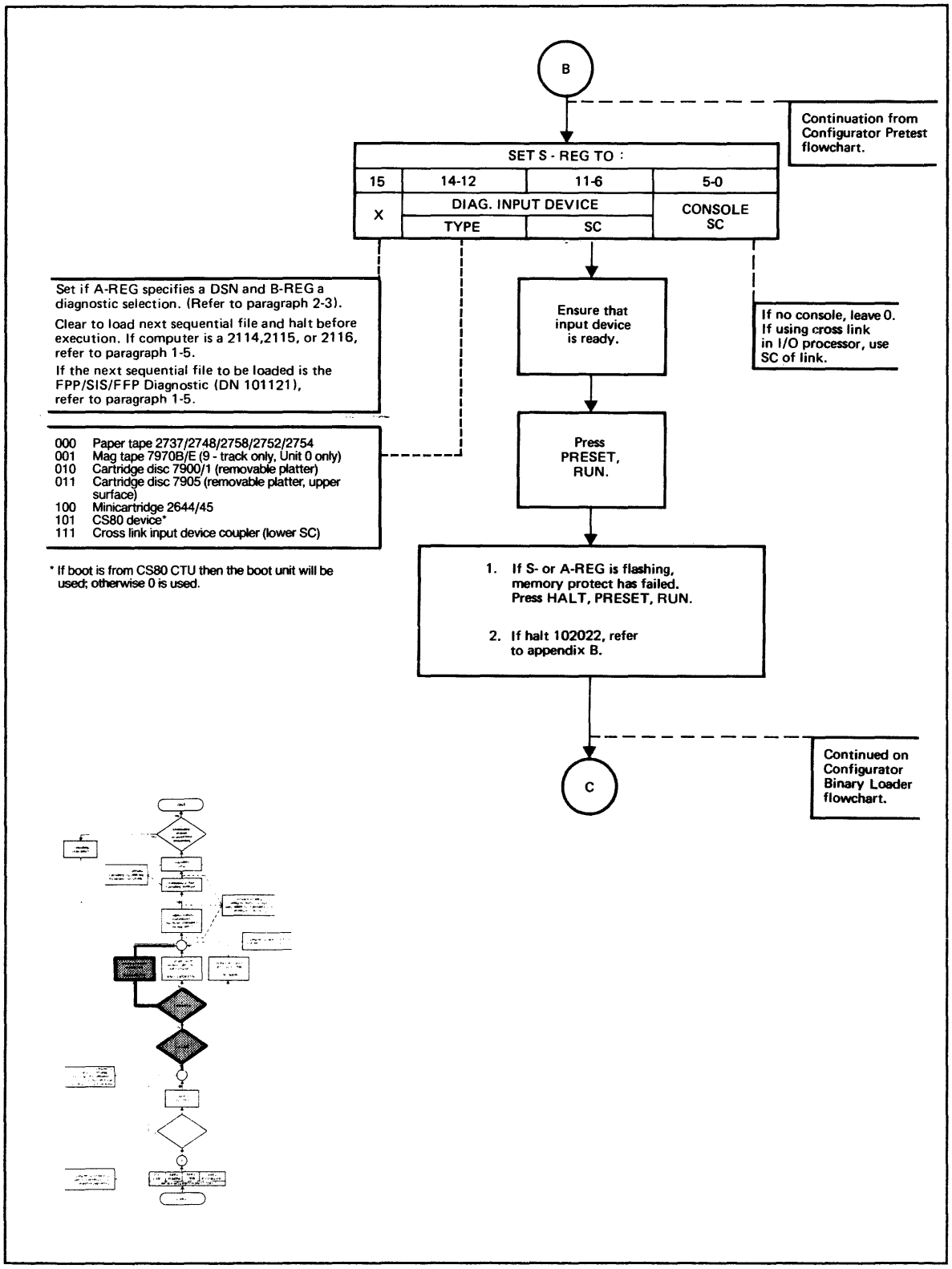
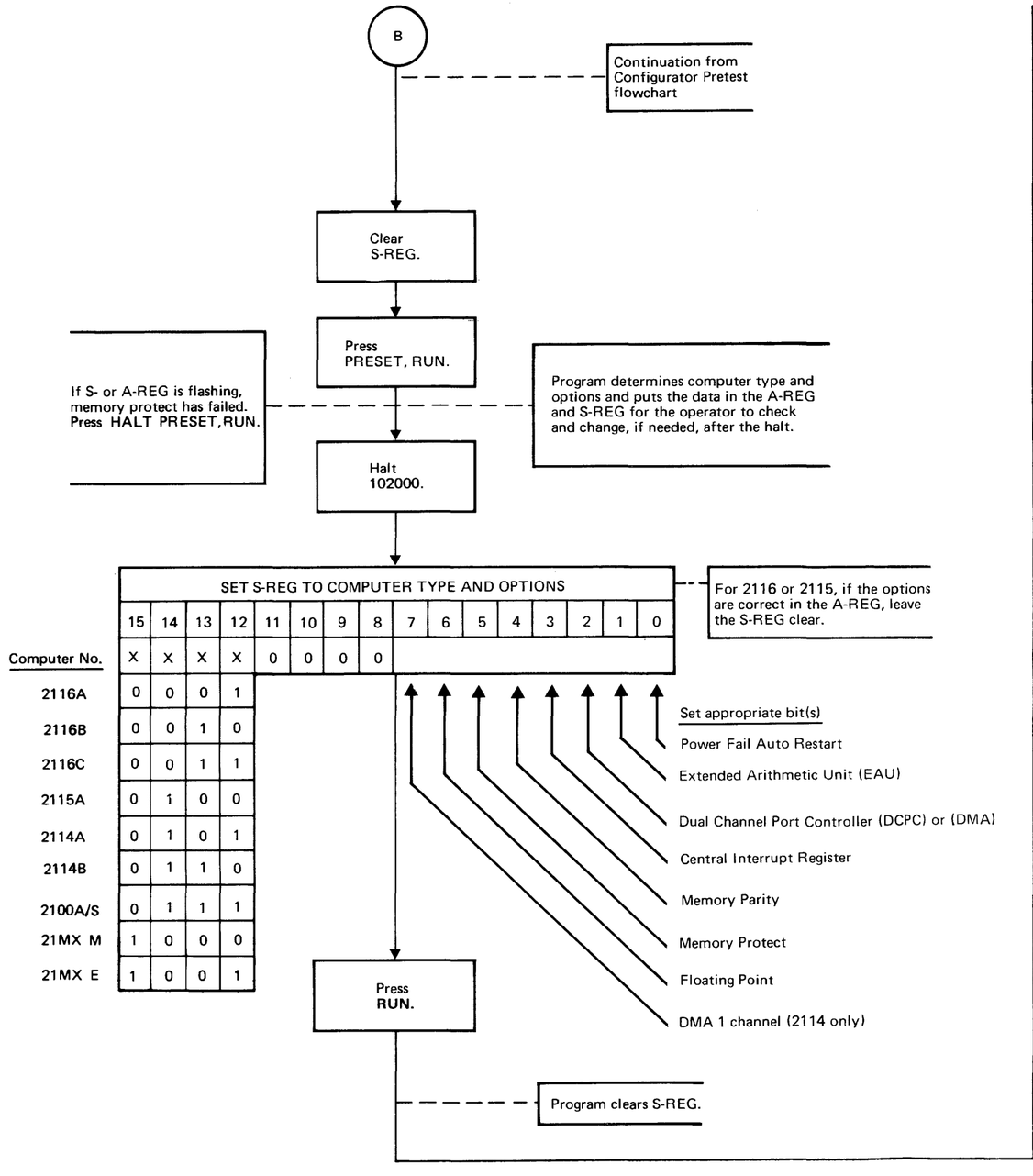
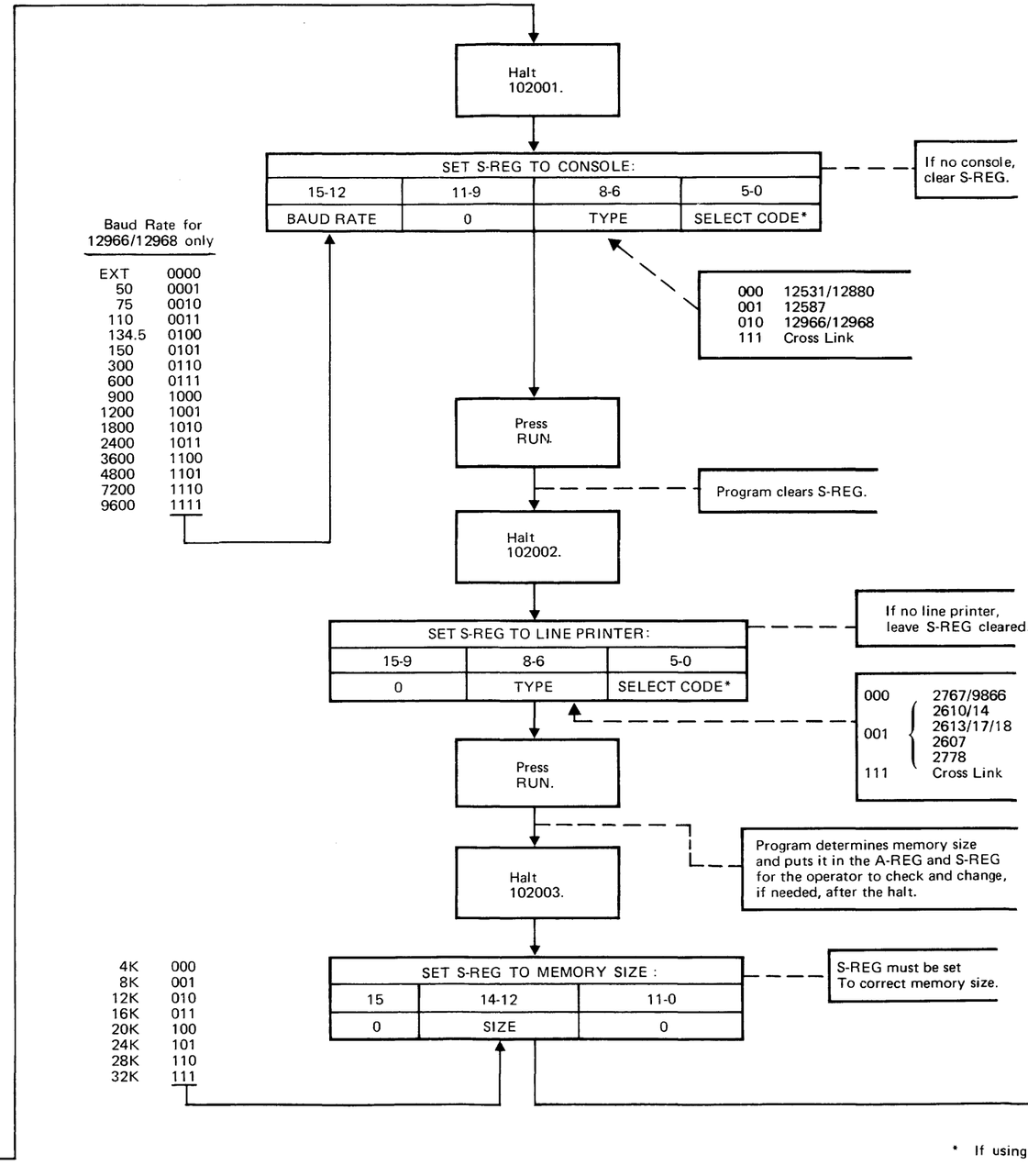
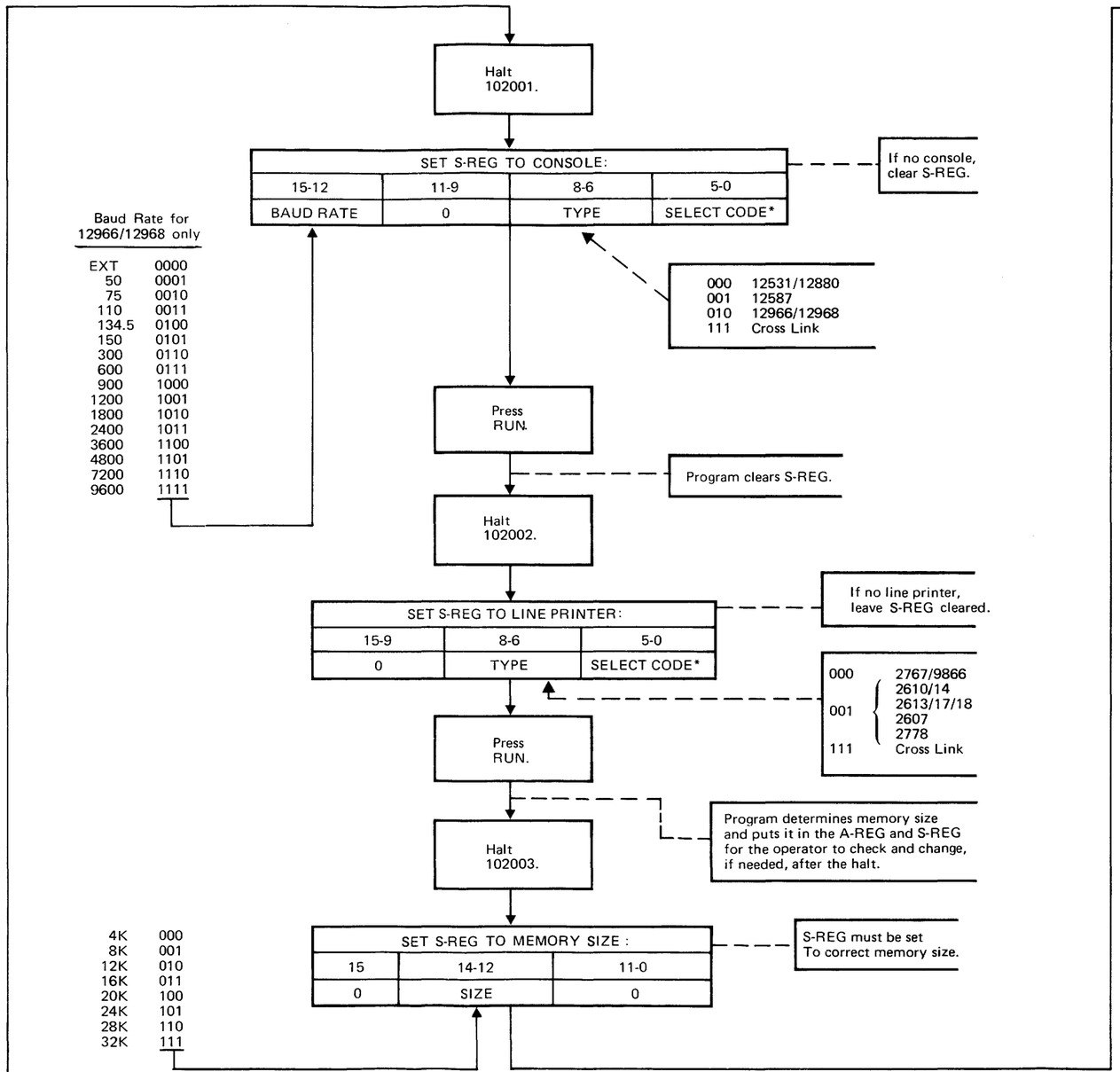

B
Continuation from Configurator Pretest flowchart.
SET S - REG TO :
15
14-12
11-6
5-0
X
DIAG. INPUT DEVICE
TYPE
SC
CONSOLE SC
Set if A-REG specifies a DSN and B-REG a diagnostic selection. (Refer to paragraph 2-3).
Clear to load next sequential file and halt before execution. If computer is a 2114,2115, or 2116, refer to paragraph 1-5.
If the next sequential file to be loaded is the FPP/SIS/FFP Diagnostic (DN 101121), refer to paragraph 1-5.
000 Paper tape 2737/2748/2758/2752/2754
001 Mag tape 7970B/E (9 - track only, Unit 0 only)
010 Cartridge disc 7900/1 (removable platter)
011 Cartridge disc 7905 (removable platter, upper surface)
100 Minicartridge 2644/45
101 CS80 device*
111 Cross link input device coupler (lower SC)
* If boot is from CS80 CTU then the boot unit will be used; otherwise 0 is used.
Ensure that input device is ready.
If no console, leave 0. If using cross link in I/O processor, use SC of link.
Press PRESET, RUN.
1. If S- or A-REG is flashing, memory protect has failed. Press HALT, PRESET, RUN.
2. If halt 102022, refer to appendix B.
C
Continued on Configurator Binary Loader flowchart.

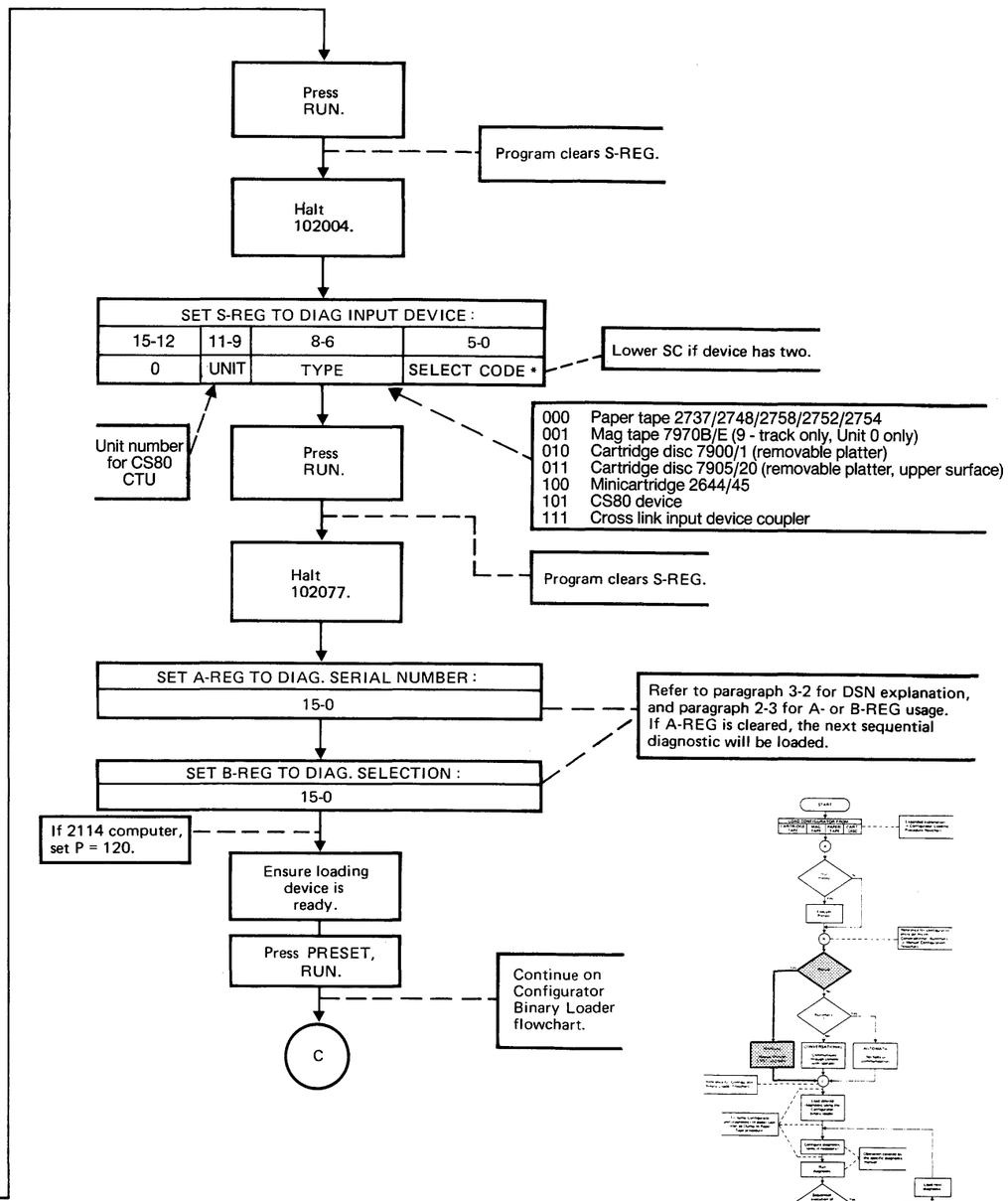
Figure 2-5. Automatic Configuration Flowchart


B
Continuation from Configurator Pretest flowchart
Clear S-REG.
Press PRESET, RUN.
If S- or A-REG is flashing, memory protect has failed. Press HALT PRESET, RUN.
Program determines computer type and options and puts the data in the A-REG and S-REG for the operator to check and change, if needed, after the halt.
Halt 102000.
SET S-REG TO COMPUTER TYPE AND OPTIONS
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
Computer No.
X X X X 0 0 0 0
2116A 0 0 0 1
2116B 0 0 1 0
2116C 0 0 1 1
2115A 0 1 0 0
2114A 0 1 0 1
2114B 0 1 1 0
2100A/S 0 1 1 1
21MX M 1 0 0 0
21MX E 1 0 0 1
For 2116 or 2115, if the options are correct in the A-REG, leave the S-REG clear.
Set appropriate bit(s)
Power Fail Auto Restart
Extended Arithmetic Unit (EAU)
Dual Channel Port Controller (DCPC) or (DMA)
Central Interrupt Register
Memory Parity
Memory Protect
Floating Point
DMA 1 channel (2114 only)
Press RUN.
Program clears S-REG.



* If using cross l




Press RUN.
Program clears S-REG.
Halt
102004.
SET S-REG TO DIAG INPUT DEVICE :
15-12
11-9
8-6
5-0
0
UNIT
TYPE
SELECT CODE *
Lower SC if device has two.
Unit number for CS80 CTU
000 Paper tape 2737/2748/2758/2752/2754
001 Mag tape 7970B/E (9 - track only, Unit 0 only)
010 Cartridge disc 7900/1 (removable platter)
011 Cartridge disc 7905/20 (removable platter, upper surface)
100 Minicartridge 2644/45
101 CS80 device
111 Cross link input device coupler
Press RUN.
Halt
102077.
Program clears S-REG.
SET A-REG TO DIAG. SERIAL NUMBER :
15-0
SET B-REG TO DIAG. SELECTION :
15-0
Refer to paragraph 3-2 for DSN explanation, and paragraph 2-3 for A- or B-REG usage. If A-REG is cleared, the next sequential diagnostic will be loaded.
If 2114 computer, set P = 120.
Ensure loading device is ready.
Press PRESET, RUN.
Continue on Configurator Binary Loader flowchart.
C

* If using cross link in I/O processor, use SC of link.

Figure 2-6. Manual Configuration

Configurator Binary Loader

The Configurator Binary Loader is used to load diagnostic programs from the following devices:

a. Paper Tape Readers; (Type 0)*: HP 2737, 2748, 2758, or teleprinter with paper tape reader.

b. Magnetic Tape; (Type 1)* (requires DMA/DCPC), (Unit 0 only): HP 7970B/E 9-track only, interfaces = 13181, 13183, 18184.

c. Cartridge Disc; (Types 2 and 3)* (requires DMA/DCPC), (Unit 0 only): HP 7900/1 Removable platter or HP 7905 Removable platter, upper surface.

   The loader utilizes memory addresses N6300 through N6500 as a sector buffer for the disc loader. Diagnostics are loaded starting at address 130 and they may extend into the sector buffer area. Therefore, prior to loading the diagnostic, the upper memory boundry required to load the diagnostic is tested. If it reaches beyond N6300, the loader program will halt with 106073 displayed. Three possible routes can then be chosen by the operator as follows:

   1. Load the desired diagnostic from a different device.

   2. Restart the loader and specify another DSN.

   3. Continue loading the diagnostic from disc but be aware that the overlayed buffer may cause unpredictable results.

d. Minicartridge Tape; (Type 4)*: HP 2644 or 2645 Terminal with 12966 interface.

e. CS/80 device: The block size must be subtracted from N6500 to arrive at the lower memory address. For a disc this results in N6300. For a CS/80 CTU the block size is 512; thus the lower bound is N5500.

f. Cross Loader Coupler; (Type 7)*: This is not a true loader but it allows the program to cross link to a loader driver in the central processor. The data checking (checksum and address violation) is done in the I/O processor (or slave) and only the device driver is used in the central processor. (See Appendix C.)

* Type numbers refer to S-Register bits 14 through 12 in Automatic Configuration and S-Register bits 8 through 6 after halt 102004 is reached in Manual Configuration. They are also placed in memory location 111 with the select code.

When using the loader, the files are searched until the specified Diagnostic Serial Number is found. If the specified DSN is not found, the program will halt 106070. When the Configurator Binary Loader has loaded the desired diagnostic and the B-Register was cleared, the program halts 102077 with the A-Register carrying the DSN contained in address 126.

To load the next consecutive binary file, clear the A- and B-Registers, set P = 120, press PRESET and RUN.

All files are assumed to be absolute and the record length is not longer than 60 words including the count, address, and checksum. The flowchart for the Configurator Binary Loader is in Figure 2-7.

Dump to Paper Tape

The Paper Tape Dump Routine can be employed to dump (a) the configured Configurator, (b) the configured Configurator and an unconfigured diagnostic, or (c) the configured Configurator and a configured diagnostic. The requirements are as follows:

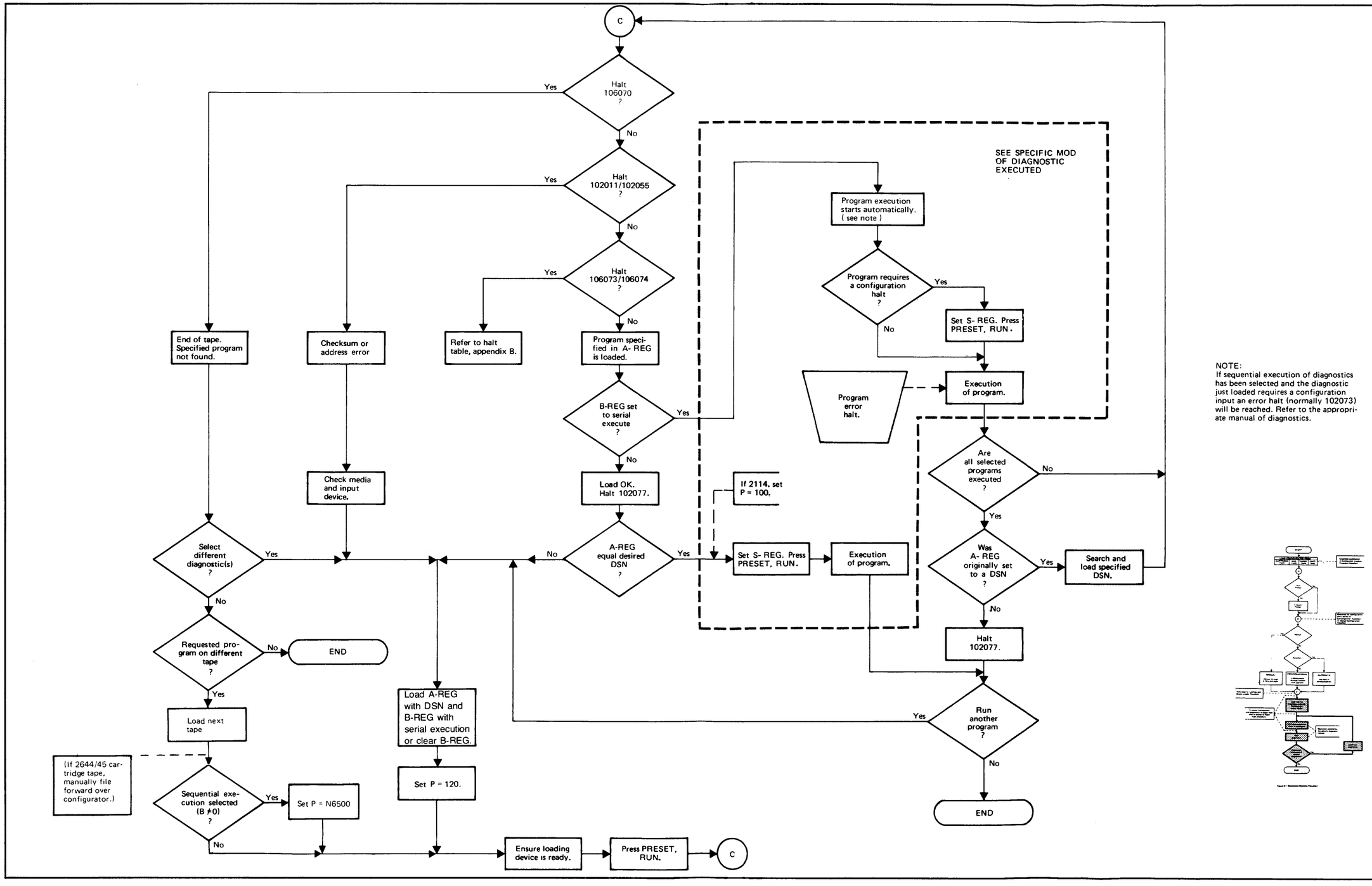
a. The paper tape loader must be specified during configuration as the diagnostic input device. The Configurator can therefore be loaded from any one of the specified input devices; the diagnostic, however, must be loaded from the paper tape reader. The Configurator must be configured manually.

b. The dump device must be one of the following:

   HP 2895, HP 2753 (punches)
   HP 2752, HP 2754 (teleprinter tape punch device)

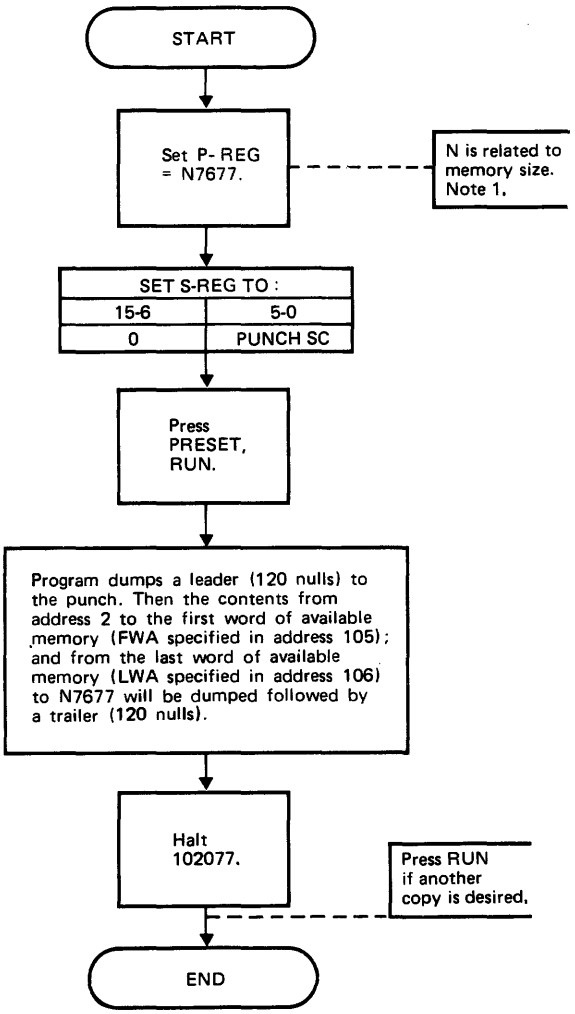
c. The desired diagnostic should be loaded. It can also be configured. If a diagnostic is not loaded, only a copy of the Configurator Linkage Area, Utility Routines, and Drivers will be dumped to tape.

The Paper Tape Dump Routine flowchart is shown in Figure 2-8.



NOTE:
If sequential execution of diagnostics has been selected and the diagnostic just loaded requires a configuration input an error halt (normally 102073) will be reached. Refer to the appropriate manual of diagnostics.

Figure 2-7. Configurator Binary Loader Flowchart


START
Set P- REG
= N7677.
N is related to
memory size.
Note 1.
SET S-REG TO :
15-6
5-0
0
PUNCH SC
Press
PRESET,
RUN.
Program dumps a leader (120 nulls) to the punch. Then the contents from address 2 to the first word of available memory (FWA specified in address 105); and from the last word of available memory (LWA specified in address 106) to N7677 will be dumped followed by a trailer (120 nulls).
Halt
102077.
Press RUN
if another
copy is desired.
END

1. N=0 for 4K, 1 for 8K, 2 for 12K, 3 for 16K, 4 for 20K, 5 for 24K, 6 for 28K, and 7 for 32K.

Figure 2-8. Paper Tape Dump Routine Flowchart

Chapter 3
Program Description

General Organization

The program is organized according to the memory map shown in Figure 3-1. The map also includes the name of the section (and chapter) that describes that area or function. The addresses shown in Figure 3-1 are effective prior to configuration. Utility Routines and Configured Drivers are moved during configuration to the corresponding addresses in the last page of memory.

The area from 130 to N6477* may be overlayed when a diagnostic is loaded.

Configurator Linkage Area

This area, starting at address 100, is reserved by the Configurator for address links to utility routines and drivers. It also has data referenced by the diagnostic for computer parameters such as DMA/DCPC available, Memory Protect, memory size, etc. Refer to Figure 3-2 for details of the linkage area.

When a diagnostic is loaded, it will overlay the JMP START (address 100), FWA (address 105), and DSN (address 126). The configurator loader does not protect the linkage area when a binary file is loaded.

The JMP START from address 100 establishes a common starting point for all diagnostics.

The FWA is the first unused memory location after the area occupied by the diagnostic. The area between the FWA and LWA is essentially unused memory. The LWA is established by the Configurator utility routines and is set to N6477 which is the last unused memory location before the routines. Some diagnostics use the area (FWA to LWA) as a buffer area. When dumping to paper tape, this area is not dumped; only locations 2 to FWA -1 and LWA +1 to N7677.

* N is related to memory size. Also see Figure 2-2, note 2.

The DSN (Diagnostic Serial Number) is used to identify any diagnostic in memory. (See Figure 3-3.) Each diagnostic is assigned a DSN when it is originally written and the revision number in the DSN is incremented each time the diagnostic is updated. The DSN allows the operator to check exactly what diagnostic and which revision of the diagnostic is loaded.

Any prereleased diagnostics or control programs will carry a pseudo-DSN of 177777. Figure 3-3 describes the DSN in detail. A diagnostic control program loads individual diagnostics, supplies parameters necessary for diagnostic execution, and/or monitors the sequential execution of discrete diagnostics.

Pretest

The Pretest consists of a check to ensure that all major base set instructions work correctly. This is a cursory check and is not meant to replace any CPU Diagnostics. Each instruction is checked in a general manner and the entire base memory is checked with several patterns. When the Pretest passes, configuration can be performed with relative assurance that the basic computer is functional.

Four possible halts that can be encountered during the Pretest are as follows:

a. When an error occurs (halt 102066) the operator must refer to the Pretest listing in Appendix D. Any malfunctions must be corrected before continuing.

b. Halts 102020 and 102021 can occur when testing a 2115 or 2116 computer where the S-Register cannot be modified under program control.

c. Halt 102077 includes successful Pretest execution.

DESCRIPTION PARAGRAPH	STARTING MEMORY ADDRESS	FUNCTION
---	10	Trap cells for I/O select codes
Configuration Linkage Area (Chapter 3)	100	Configurator linkage area (Figure 3-2)
Pretest (Chapter 3)	130	Pretest part A
---	1400	Storage
Pretest (Chapter 3)	3000	Establish computer parameters (memory size, DMA, MPRT, and computer type)
Configuration of Drivers (Chapter 3)		Configuration of drivers a. Console b. Line printer c. Diagnostic input device
Manual Configuration (Chapter 2)		Manual configuration
Table of Drivers (Chapter 3)	4000	Table of drivers a. Consoles b. Line printers c. Diagnostic input devices
Utility Routines (Chapter 3)	N6500	Utility routines
Configured Drivers (Chapter 3)	N7000	Configured drivers a. Console driver b. Line printer driver c. Diagnostic input device driver
---	N7700	Basic Binary Loader (protected area or IBL)

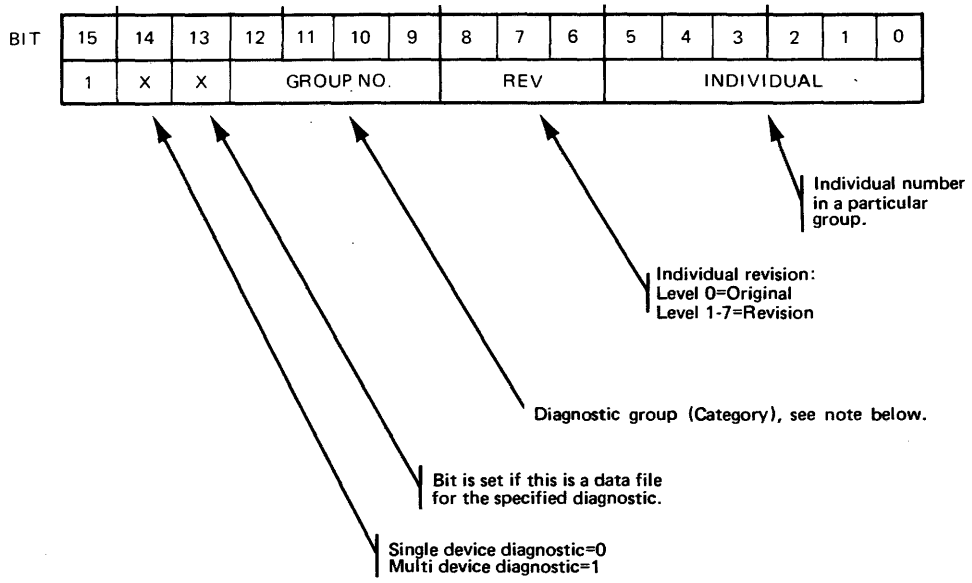
Note: The shaded area represents an area protected by the Configurator or an area within the BBL. An attempt to write into location N6500-N7777, when using the Configurator Binary Loader, will result in a halt 102055. Any programs loaded shall not overwrite the configurator linkage area (location 100-127) except locations, 100, 105, 116 and 126.

Figure 3-1. Memory Map

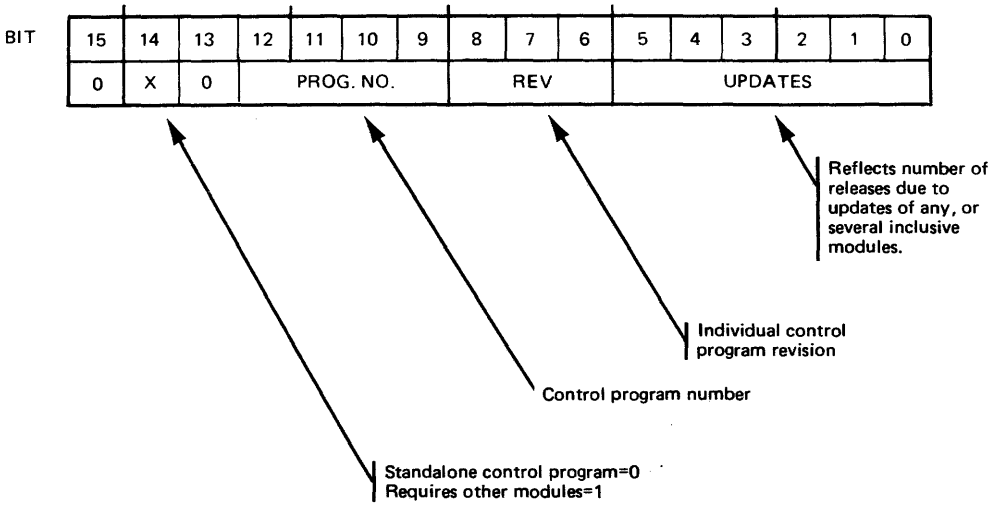
OCTAL ADDRESS	CONTENTS	MEANING
100	JMP START	GO TO START OF USER PROGRAM
101	NOP	RESERVED
102	DEF CNSLO	CONSOLE OUTPUT DRIVER
103	DEF LNPTR	LINE PRINTER DRIVER
104	DEF CNSLI	CONSOLE INPUT DRIVER
105 FWA	OCT 130	FIRST WORD OF AVAILABLE MEMORY
106 LWA	OCT 6477	LAST WORD OF AVAILABLE MEMORY
107	DEF LOADR	LOADER PROGRAM
110 TMC	DEC -200	1 MILLISEC. TIME COUNT
111	OCT 0	LOADER SELECT CODE
112	OCT 0	CONSOLE SELECT CODE (0 = NOT AVAILABLE)
113	OCT 0	LINE PRINTER SELECT CODE (0 = NOT AVAILABLE)
114	OCT 0	CONSOLE SELECT CODE (0 = NOT AVAILABLE)
115	OCT 0	COMPUTER TYPE/OPTIONS
116	OCT 0	USER CARD TYPE AND SC
117	OCT 0	MEMORY SIZE
120	JSB 107B,1	GO TO LOADER PROGRAM
121	DEF TMR	1 MILLISEC. TIMER ROUTINE
122	DEF SWR	CHECK S-REG
123	DEF D2ASC	DECIMAL TO ASCII CONVERSION
124	DEF 02ASC	OCTAL TO ASCII CONVERSION
125	DEF ASC2N	ASCII TO NUMBER CONVERSION
126 DSN	OCT 000200	DIAGNOSTIC SERIAL NUMBER (CONF./REV. 1)
127	DEF FMTR	FORMATTER ROUTINE

Figure 3-2. Linkage Area

DIAGNOSTIC PROGRAMS


BIT
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
1 X X GROUP NO. REV INDIVIDUAL
Individual number in a particular group.
Individual revision: Level 0=Original Level 1-7=Revision
Diagnostic group (Category), see note below.
Bit is set if this is a data file for the specified diagnostic.
Single device diagnostic=0 Multi device diagnostic=1

DIAGNOSTIC CONTROL PROGRAMS


BIT
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
0 X 0 PROG. NO. REV UPDATES
Reflects number of releases due to updates of any, or several inclusive modules.
Individual control program revision
Control program number
Standalone control program=0 Requires other modules=1

NOTE: The DSN is always at location 126.
See appendix A for DSN examples.

REV. B

Figure 3-3. Diagnostic Serial Number (DSN)

Computer Parameters

The parameters calculated by the program are: Computer Type, DMA/DCPC, Memory Protect, and Memory Size. After being calculated, the computer type is used to look up the standard features, and the 1-millisecond timing constant. See Figure 3-4 for computer type and options parameter details and Figure 3-5 for memory size parameter details.

BIT	SET IF AVAILABLE	21MX E	21MX M	2100 A/S	2116 A/B/C	2115 A	2114 A
0	POWER FAIL AUTO RESTART	1	1	1 1	X X X	X	X X
1	EXTENDED ARITHMETIC UNIT	1	1	1 1	X X X	X	0 0
2	DMA/DCPC	X	X	X 1	X X X	X	0 X
3	CENTRAL INTERRUPT REG.	1	1	1 1	X*1 1	X*	0 1
4	MEMORY PARITY CHECK	1	1	1 1	X X X	X	X X
5	MEMORY PROTECT	X	X	1 1	X X X	0	0 0
6	FLOATING POINT	1	1	X 1	0 0 0	0	0 0
7	DMA (1 CHANNEL ONLY)	0	0	0 0	0 0 0	0	0 1
8	RESERVED	0	0	0 0	0 0 0	0	0 0
9	RESERVED	0	0	0 0	0 0 0	0	0 0
10	RESERVED	0	0	0 0	0 0 0	0	0 0
11	RESERVED	0	0	0 0	0 0 0	0	0 0
12	COMPUTER TYPE CODE	1	0	1 1	1 0 1	0	1 0
13		0	0	1 1	0 1 1	0	0 1
14		0	0	1 1	0 0 0	1	1 1
15		1	1	0 0	0 0 0	0	0 0

NOTES: * = ON EARLIER MODELS THIS WAS AN OPTION
X = OPTIONAL FEATURE AVAILABLE ON INDICATED COMPUTER
0 = FEATURE NOT AVAILABLE ON INDICATED COMPUTER
1 = STANDARD FEATURE ON INDICATED COMPUTER

LINKAGE AREA, ADDRESS 115

Figure 3-4. Computer Type and Options

The calculated parameters are printed on the console device when Conversational Configuration is used. They are displayed in the A- and S-Registers when Manual Configuration is used. The display of parameters is for operator reference. If the parameters are wrong, it is a direct indication that the appropriate hardware has failed. The operator can correct the parameters by using Manual Configuration.

In determining the computer type, it should be noted that the Configurator cannot distinguish between a 2115 and 2116 computer. The program will default to a 2115 calculation if the calculated memory size is 8K or less.

The S-Register will flash to indicate a hardware problem if one exists when checking for MPRT. The operator must press HALT, PRESET, RUN.

Configuration of Drivers

The device drivers are written in such a way that only the basic hardware differences (in programming for each device and interface) are kept in a table. One table is used for each driver (console line printer and diagnostic input device). When a device is specified, the appropriate driver is moved from the table to the driver area of the Configurator. During the move the select code is set to the one specified by the operator. If a cross link is specified, the program will only configure the driver that has been loaded into the driver area. Refer to Appendix C. If no device is specified, a pseudo-driver is used so that if the diagnostic calls that driver, no action is taken. The select code in the base page is also cleared to indicate that there is no device for that driver. When using Conversational or Automatic Configuration, the Configurator program determines the console interface type installed in the select code specified by the operator. If the Configurator is unsuccessful in determining the interface type, the program will halt 102022. The operator must enter a new select code or use Manual Configuration.

If a line printer was not specified during configuration, a pseudo-driver is used to call the console output driver. Therefore, in the event the diagnostic calls the line printer driver, the message will appear on the console.

The Configurator program asks for the device model number of the diagnostic input device and the select code during configuration. This data is used to look up the Binary Loader driver.

MEMORY SIZE	15	14	13	12	11-0
4K	0	0	0	0	0
8K	0	0	0	1	0
12K	0	0	1	0	0
16K	0	0	1	1	0
20K	0	1	0	0	0
24K	0	1	0	1	0
28K	0	1	1	0	0
32K	0	1	1	1	0
LINKAGE AREA, ADDRESS 117					

Figure 3-5. Memory Size

If the diagnostic input device model number cannot be found during input, the request line will be output repeatedly until a valid device number is entered. The same situation applies to the select code if the entry is greater than 77 or less than 10.

Table of Drivers

The tables consist of console, line printer, and diagnostic input device drivers. The drivers in each table are written in a format that can be relocated to the driver routine area of memory during configuration. Primarily, the tables represent hardware differences (in programming) that must be known in order to interface with the driver routines.

The tables contain the following device drivers:

a. Console: 12531/12880
12587
12966

b. Line printer: 2767/9866
2607/2610/2613/2614/2617/2618/2778

c. Diagnostic Input Device:

Paper tape:	2737, 2748, 2758 (or teleprinter)
Magnetic tape:	7970B/E (9-track unit 0)
Cartridge disc:	7900/1 (unit 0, removable platter only)
Cartridge disc:	7905/20 (unit 0, removable platter, upper surface only).
Minicartridge:	2644/2645 terminal
CS/80 cartridge tape:	HP 7911/12/14 disc with integrated CTU or 9144 stand alone CTU.

Utility Routines

The following six paragraphs, listed below, describe the calling sequence for each of the Utility routines. The routines are generally required by diagnostics and are therefore incorporated in the configurator and are not overlayed by the diagnostic. These routines do not change the interrupt system and are interruptable at any point if the interrupt system is enabled.

a. Timer or Wait Loop

b. S-REG Check

c. Decimal (Integer) to ASCII Conversion

d. Octal to ASCII Conversion

e. ASCII to Number (Binary) Conversion

f. Formatted Output

The routines will not be directly used by the operator and are described here only to provide a broader scope of understanding the Configurator. The information can be used as a basis for creating individual diagnostics to run under the Configurator.

Timer or Wait Loop (One Millisecond)

CALLING SEQUENCE:

```
          LDA    TIME      NUMBER OF MILLISECONDS
P         JSB    121B,I    GO TO TIMER
P+1       ...              NORMAL RETURN

TIME      DEC    100       100 MILLISECONDS
```

From P to P+1 = Time x 1 millisecond

S-Register Check

CALLING SEQUENCE:

```
            LDB     SW10        SWITCH NUMBER
     P      JSB     122B,I      CHECK IT
     P+1    ...                 RETURN IF SWITCH(ES) IS ON
     P+2    ...                 RETURN IF SWITCH IS OFF

     SW10   OCT     002000      S-REG BIT 10
```

Upon entry, the B-Register contains the mask for the switch(es) of interest. The return is P+2 if the switch is off (or all off) or P+1 if any switches in question are on.

Decimal to ASCII Conversion

CALLING SEQUENCE:

```
            CLE                 START WITH UPPER HALF (CCE = LOWER*)
            LDA     DECNO       GET NUMBER FOR CONVERSION
            LDB     BFPTR       GET LOCATION IN BUFFER TO STORE THE
                                CONVERTED NUMBER
            JSB     123B,I      MAKE CONVERSION
            ...                 NORMAL RETURN
     DECNO  DEC     -32000      DECIMAL VALUE
     BFPTR  DEF     ***         POINTER TO BUFFER
```

The above call will result in the following:

```
     BFPTR  --      3
            2       0       ASCII characters in memory
            0       0
```

NOTE

The routine does a right justify. The contents of the A- and B-Registers are lost.

Octal to ASCII Conversion

CALLING SEQUENCE:

```
            CLE             START WITH UPPER HALF (CCE = LOWER*)
            LDA     OCTN    GET OCTAL NUMBER TO BE CONVERTED TO ASCII
            LDB     BFPTR   GET LOCATION IN BUFFER TO STORE THE
                            CONVERTED NUMBER
            JSB     124B,I  MAKE CONVERSION
            ...             NORMAL RETURN
OCTN        OCT     034567
```

The above call will result in the following:

```
BFPTR   0       3
        4       5       ASCII characters in memory
        6       7
```

NOTE

The routine does a right justify. The contents of the A- and B-Registers are lost.

* A four-word buffer is required in this mode.

ASCII to Binary Conversion

Converts a decimal or octal ASCII coded number in memory to a binary number and puts it in the A-Register. This routine will accept ASCII numbers only, 60 to 70 (octal). Any other characters will terminate the conversion or the routine will terminate after converting the sixth character.

CALLING SEQUENCE:

```
            CLA             DECIMAL CONVERSION (CCA = OCTAL)
            LDB     BFPTR   GET LOCATION IN BUFFER TO STORE THE
                            CONVERTED NUMBER
            CLE             START WITH UPPER HALF (CCE = LOWER*)
            JSB     125B,I  MAKE CONVERSION
            ...             NORMAL RETURN
                            A-REG = CONVERTED NUMBER
                            B-REG = BUFFER ADDRESS OF NEXT CHARACTER
                            E-REG = UPPER/LOWER CHARACTER*
```

Formatted Output

To make it easier for programming, a simple format output call is available. This allows more room for the diagnostic.

CALLING SEQUENCE:

```
            CLA,   CLE (see Note 1)   FORMAT STARTING
            LDB    FMTA               POINTER TO FORMAT STRING
            JSB    127B,I             CALL FOR OUTPUT
            ...                       NORMAL RETURN
                                      A = 0 (OUTPUT COMPLETE)
                                      B = 0
                                      or
                                      A = 43 (# WAS REQUESTED)
                                      B = N.A.
FMTA        DEF    *+1
            ASC    7,FORMAT OUTPUT/
```

FORMAT CONTROL CHARACTERS:

```
  # = NUMBER OUTPUT (See explanation next page)
  / = OUTPUT BUFFER WITH A CR-LF (OR PRINT IF OUTPUTTING TO LINE PRINTER
← = OUTPUT BUFFER WITHOUT A CR-LF (OR SUPPRESS PRINT OF PENDING
    BUFFER, IF OUTPUTTING TO LINE PRINTER, UNTIL A /CONTROL CHARACTER
    IS ENCOUNTERED)
  / = Or ← will cause a return with the original A- and B-REGS
```

NOTE

1. *CLA, CLE = OUTPUT TO CONSOLE*
   CLA, CCE = OUTPUT TO LINE PRINTER

* A four-word buffer is required in this mode.

CALLING SEQUENCE (number output):

This call can be used only in conjunction with the calling sequence above.

```
            CCA    (see Note 2)    OUTPUT NUMBER (OCTAL)
            LDB    NMBR            GET NUMBER FOR OUTPUT
            JSB    127B,I          CONTINUE FORMAT OUTPUT WITH NUMBER RETURN
```

NOTE

2. *CCA = OUTPUT NUMBER IN OCTAL*
   CLA, INA = OUTPUT NUMBER IN DECIMAL

If a call is made for a number output but a format has not been established, no action is taken and control is returned to P+1.

When the Format routine is started (A=0), the formatter moves each character in the string to a buffer. Each character is examined for the three control characters. If the character is #, a jump back to the caller is made. The program then indicates the type of conversion and passes the number back. The number is then converted and added to the buffer. The formatter will then continue to move each character until another control character is found. If the output string is larger than the format buffer, the buffer is output but no CR-LF or PRINT command is given. This process continues until a terminating control character is found (/ or ←).

Configured Drivers

The following paragraphs (listed below) describe the calling sequence for each of the drivers (console, line printer, and diagnostic input device) available to the diagnostic program.

a. Console Output

b. Console Input

c. Line Printer Output

d. Binary Loader

Console Output

a. Calling Sequence:

```
LDA    CNT       BUFFER COUNT
LDB    BUFA      BUFFER ADDRESS
JSB    102B,I    CALL CONSOLE OUTPUT DRIVER
...              RETURN WHEN COMPLETE
...              A + B MEANINGLESS
```

b. Count and Address:

The count is the positive number of 8-bit characters in the buffer. The address is the absolute memory location of the first byte in the buffer.

NOTE

The count cannot be negative, the results are unpredictable. A buffer count of zero will issue a CR-LF in the buffer.

c. Call Console Output Driver:

This call will initialize an output of the specified buffer. The buffer is unpacked 8 bits (1 byte) at a time and transferred to the console. When the transfer has reached the count, a carriage return (CR) line feed (LF) is issued and the driver returns to the caller. If, during a transfer, a RUBOUT character is found, the driver will return to the caller at that point regardless of the remaining count, and no carriage return or line feed is issued.

Console Input

a. Calling Sequence:

```
LDA     CNTMX     MAXIMUM INPUT COUNT
LDB     BUFA      BUFFER ADDRESS
JSB     104B,I    CALL CONSOLE INPUT DRIVER
                  RETURN WHEN COMPLETE
                  A = NUMBER OF CHARACTERS INPUT BY THE OPERATOR
                  B = MEANINGLESS
```

b. Count and Address:

The count is the positive maximum number of 8-bit characters to be input and loaded into the buffer. The address is the absolute memory of the buffer.

NOTE

The count cannot be negative or zero, the results are unpredictable.

c. Call Console Input Driver:

This call will initialize an input from the console device. The characters will be put in the buffer in packed format (8-bit bytes) until the operator enters a CR (carriage return), or the buffer is filled.

NOTE

The driver automatically takes care of a RUBOUT (or delete) by the operator, issues a CR-LF, and resets the pointers to the start of the buffer. The driver requires only a CR to terminate an input.

d. Return:

When the operator enters a line feed, or the buffer is filled, the drive will return to the caller with the A-REG set to the input count.

Line Printer Output

The same rules apply as for the Console Output driver except:

a. The JSB is JSB 103B,I.

b. A halt 106076 will occur if the line printer is not ready.

Appendix A
Diagnostic Serial Numbers

Major groups are listed first (these are the prefixes for the DSN's). Specific DSN's follow this listing.

DSN	DIAGNOSTIC GROUP
000RXX	Control Programs
100RXX	Reserved
101RXX	CPU
102RXX	Memory
103RXX	Interface Cards
104RXX	Consoles
105RXX	Line Printers
106RXX	Tape Readers/Punches
107RXX	Plotters
110RXX	Reserved
111RXX	Discs
112RXX	Mag Tapes
113RXX	Card Readers
114RXX	Reserved
116RXX	Reserved
117RXX	Special Peripherals
177777	Prereleased Program

Notes: See Figure 3-3 in Chapter 3 for explanations.
R = revision.

All 1's in the DSN represent a prereleased diagnostic or control program.

A diagnostic reference table is presented in Table A-1, which lists the DSN's, diagnostic designations, part numbers, and date codes for the HP 2100 Series diagnostic media and the appropriate diagnostic reference manuals used with this Configurator.

24396A-F Products Cross Reference List

PRODUCT NO.	NAME	PARTS SUPPLIED WITH PRODUCT	
		SOFTWARE	MANUALS
24396A	DIAGNOSTIC LIBRARY ON PAPER TAPES	24296-60001 24396-12001 24396-12002 24396-12003 12943-16002 12943-16001 12907-16003 12977-16004 12977-16005 12740-16001 12929-16001 24395-16002 12539-16001 12936-16001 12908-16001 13197-16002 24335-16001 59310-16001 12587-16001 12920-16001 12920-16002 12621-16001 12622-16001 12967-16001 12966-16001 12968-16001 24340-16001 02618-16001 02631-16001 02635-16001 02608-16001 12996-16001 12732-16003 12960-16001 12962-16001 92900-16001 13181-16001 13184-16001 24296-16003 24296-16002 12597-16001 12560-16001 12924-16001 12989-16001 12531-16001 24351-16001 24360-16001	24396-14001 24396-14002 24396-14003 24396-14004
24396B	DIAGNOSTIC LIBRARY ON 7900/01 CARTRIDGE DISC	24396-13001	
24396C	DIAGNOSTIC LIBRARY ON 7905 CARTRIDGE DISC	24396-13101	
24396D	DIAGNOSTIC LIBRARY ON 7970B MAGNETIC TAPE (800 BPI)	24396-13501	
24396E	DIAGNOSTIC LIBRARY ON 7970E MAGNETIC TAPE (1600 BPI)	24396-13601	
24396F	DIAGNOSTIC LIBRARY ON 2644/45 MINICARTRIDGES	24396-13301 24396-13302 24396-13303 24396-13304 24396-13305 24396-13306 24396-13307	
24396H	DIAGNOSTIC LIBRARY ON CS80 CARTRIDGE TAPES	24396-13321	

*The diagnostics and control programs listed in this reference table are stored on the appropriate media in the sequence specified by the table. This does not imply that a specific system delivered to a user is compatible with all the hardware listed in this table.

Table A-1. Diagnostic Reference Table for HP 24396A-F Products

DSN	DESIGNATION	REQ MEM SIZ	SINGLE FILE PAPER TAPE			MULTIPLE FILES						
			BINARY	D.C.	MANUAL	PAPER TAPE BINARIES	PAPER TAPE D.C.	2644/45 CARTRIDGE BINARIES	2644/45 CARTRIDGE D.C.	DISC/MAG TAPE BINARIES	DISC/MAG TAPE D.C.	MANUAL VOL.
000200	DIAGNOSTIC CONFIGURATOR	4K	24296-60001	1627	02100-90157	24296-60001	1627	THE DIAGNOSTIC CONFIGURATOR IS THE FIRST FILE ON EVERY CARTRIDGE TAPE, DISC AND MAG TAPE.				
101100	MEMORY REFERENCE INSTRUCTION GROUP	4K	24315-16001	1624	02100-90218							
101001	ALTER SKIP INSTRUCTION GROUP	4K	24316-16001	1431	02100-90211							
101002	SHIFT ROTATE INSTRUCTION GROUP	4K	24317-16001	1431	02100-90212	24396-12001	1644					
102200	CORE MEMORY (2100/16/15/14)	4K	24323-16001	1624	02100-90219							
102104	SEMICONDUCTOR MEMORY (21MX)	4K	24395-16001	1644	24395-90001							24396-14001
101004	EAU INSTRUCTION GROUP	4K	24319-16001	1431	02100-90214							
101207	FLOATING POINT INSTRUCTION GROUP	4K	24320-16001	1551	24320-90001	24396-12002	1901	24396-13301	2326			
102305	MEM PROT/PARITY ERROR (2100/21MX)	4K	12892-16001	1705	12892-90005							
101206	POWER FAIL AUTO RESTART	4K	24321-16001	1635	02100-90216							
141203	I/O INSTR-GROUP I/O CHANNEL EXTENDER	8K	24318-16001	2326	02100-90213							
143300	GENERAL PURPOSE REGISTER	4K	24391-16001	1813	24391-90001	24396-12003	2326					
101220	DIRECT MEMORY ACCESS (2100/21MX)	4K	24322-16002	1705	24322-90002							
101011	EXT. INSTR. GROUP (INDEX)	4K	12943-16002	1432	12943-90004							
101112	EXT. INSTR. GROUP (WORD,BYTE,BIT)	4K	12943-16001	1728	12943-90004							
101110	2100 FAST FORTRAN PACKAGE	4K	12907-16003	1632	12907-90003							
101213	M/E-Series FAST FORTRAN PACKAGE 1	4K	12977-16004	1822	12977-90002			24396-13302	1926			
101114	M/E-Series FAST FORTRAN PACKAGE 2	4K	12977-16005	1632	12977-90002							
101121	F-Series FPP/SIS/FFP	16K	12740-16001	1926	12740-90004							
102103	MEMORY EXPANSION UNIT	16K	12929-16001	1830	12929-90003							24396-14002
102006	SEMICOND MEMORY, MICROCODED F.21MX	4K	24395-16002	1644	24395-90003							
103301	TIME BASE GENERATOR	4K	12539-16001	1830	12539-90011					7900 DISC:		
103115	12936 PRIVILEGED INTERRUPT	4K	12936-16001	1643	12936-90003					24396-13001	2040	
103105	12908/12978 WCS 256 W.	4K	12908-16001	1502	12908-90013			24396-13303	1830			
103023	13197 WCS 1024 W.	4K	13197-16002	1640	13197-90002					7905 DISC:		
103207	12889 HARDWIRED SERIAL INTERFACE	4K	24335-16001	1717	02100-90169					24396-13101	2040	
103122	59310 INTERF. BUS INTERFACE	4K	59310-16001	1728	59310-90061							
103003	12587 ASYN. DATA SET INTERF.	8K	12587-16001	1552	12587-90013					7970B MAG TAPE: 24396-13501	2040	
103110	12920 ASYN. MULTIPLEXER (DATA)	4K	12920-16001	1805	12920-90009							
103011	12920 ASYN. MULTIPLEXER (CNTL)	4K	12920-16002	1444	12920-90009					7970E MAG TAPE:		
103012	12621 SYNC. DATA SET (RECEIVE)	4K	12621-16001	1532	12621-90008					24396-13601	2040	
103013	12622 SYNC. DATA SET (SEND)	4K	12622-16001	1532	12622-90008			24396-13304	1928			
103116	12967 SYNC. INTERFACE	4K	12967-16001	1438	12967-90001							
103017	12966 ASYN. DATA SET	8K	12966-16001	1519	12966-90004							24396-14003
103121	12968 ASYN. COMM. INTERFACE	4K	12968-16001	1602	12968-90003							
103024	12821 ICD DISC INTERFACE	8K	12821-16001	1928	12821-90002							
105102	2607 LINE PRINTER	4K	24340-16001	1446	12987-90004							
145103	2613/17/18 LINE PRINTER	4K	02618-16001	1633	02618-90006							
105106	2631 PRINTER	8K	02631-16001	1913	02631-90906							
105107	2635 PRINTING TERMINAL	8K	02635-16001	1913	02635-90906			24396-13305	2026			
105105	2608 LINE PRINTER	8K	02608-16001	2026	02608-90906							
105104	9866 LINE PRINTER	4K	12996-16001	1541	12996-90001							
111104	12732 FLEXIBLE DISC SUBSYSTEM	8K	12732-16003	1708	12732-90003							
151302	7900/01 CARTRIDGE DISC	8K	12960-16001	1805	12960-90003							
151403	7905/06/20/25 DISC	16K	12962-16001	1805	12962-90001			24396-13306	1901			
104117	92900 TERMINAL SUBSYS (3070,40280)	8K	92900-16001	1814	92900-90003							
112200	9-TRACK MAG TAPE (7970, 13181/3)	8K	13181-16001	2040	13181-90095							
112102	7/9 TRACK MAG TAPE (13184 INTF)	8K	13184-16001	1629	13184-90008							
010000	DIAGNOSTIC CROSS LINK	4K	24296-16003	1627	02100-90157							24396-14004
011000	7900/05/20 DISC INITIALIZATION	4K	24296-16002	1627	02100-90157							
146200	PAPER TAPE READER-PUNCH	4K	12597-16001	1725	12597-90031							
107000	DIG. PLOTTER INTERFACE (CALCOMP)	4K	12560-16001	1540	12560-90029			24396-13307	2040			
113100	2892 CARD READER	4K	12924-16001	1537	12924-90006							
113001	2894 CARD READER PUNCH	8K	12989-16001	1728	12989-90001							
104003	TELEPRINTER	4K	12531-16001	1509	12531-90042							
104007	2615 VIDEO TERMINAL	4K	24351-16001	1347	02615-90002							
103006	12909B PROM WRITER	4K	24360-16001	1420	24360-90001							

Table A-2. Diagnostic Reference Table for Part No. 24009-14002

DSN	DESIGNATION*	REQ MEM SIZ	SINGLE FILE PAPER TAPE			MULTIPLE FILES	
			BINARY	D.C.	MANUAL	2645 CARTRIDGE BINARIES	2645 CARTRIDGE D.C.
000200	DIAGNOSTIC CONFIGURATOR	4K	24296-60001	1627	02100-90157	THE DIAGNOSTIC CONFIGURATOR IS THE FIRST FILE ON EVERY CARTRIDGE TAPE.	
101100	MEMORY REFERENCE INSTRUCTION GROUP	4K	24315-16001	1624	02100-90218		
101001	ALTER SKIP INSTRUCTION GROUP	4K	24316-16001	1431	02100-90211		
101002	SHIFT ROTATE INSTRUCTION GROUP	4K	24317-16001	1431	02100-90212		
102104	SEMICONDUCTOR MEMORY (21MX)	4K	24395-16001	1644	24395-90001		
101004	EAU INSTRUCTION GROUP	4K	24319-16001	1431	02100-90214		
101207	FLOATING POINT INSTRUCTION GROUP	4K	24320-16001	1551	24320-90001		
102305	MEM PROT/PARITY ERROR (2100/21MX)	4K	12892-16001	1705	12892-90005	24998-13301	2326
101206	POWER FAIL AUTO RESTART	4K	24321-16001	1635	02100-90216		
141203	I/O INSTR GROUP I/O CHANNEL/EXTENDER	8K	24318-16001	2326	02100-90213		
143300	GENERAL PURPOSE REGISTER	4K	24391-16001	1813	24391-90001		
101220	DIRECT MEMORY ACCESS (2100/21MX)	4K	24322-16002	1705	24322-90002		
101011	EXT. INSTR. GROUP (INDEX)	4K	12943-16002	1432	12943-90004		
101112	EXT. INSTR. GROUP (WORD,BYTE,BIT)	4K	12943-16001	1728	12943-90004		
101213	M/E-Series FAST FORTRAN PACKAGE 1	4K	12977-16004	1822	12977-90002		
101114	M/E-Series FAST FORTRAN PACKAGE 2	4K	12977-16005	1632	12977-90002		
101121	F-Series FPP/SIS/FFP	16K	12740-16001	1926	12740-90004		
102103	MEMORY EXPANSION UNIT	16K	12929-16001	1830	12929-90003		
102006	SEMICOND MEMORY, MICROCODED F.21MX	4K	24395-16002	1644	24395-90003	24998-13302	1926
103301	TIME BASE GENERATOR	4K	12539-16001	1830	12539-90011		
103023	13197 WCS 1024 W.	4K	13197-16002	1640	13197-90002		
103110	12920 ASYN. MULTIPLEXER (DATA)	4K	12920-16001	1805	12920-90009		
103011	12920 ASYN. MULTIPLEXER (CNTL)	4K	12920-16002	1444	12920-90009		
103012	12621 SYNC. DATA SET (RECEIVE)	4K	12621-16001	1532	12621-90008		
103013	12622 SYNC. DATA SET (SEND)	4K	12622-16001	1532	12622-90008		
103116	12967 SYNC. INTERFACE	4K	12967-16001	1438	12967-90001	24998-13303	1928
103017	12966 ASYN. DATA SET	8K	12966-16001	1519	12966-90004		
104003	TELEPRINTER	4K	12531-16001	1509	12531-90042		
103207	12889 HARDWIRED SERIAL INTERFACE	4K	24335-16001	1717	02100-90169		
103122	59310 INTERF. BUS INTERFACE	4K	59310-16001	1728	59310-90061		
103024	12821 ICD DISC INTERFACE	8K	12821-16001	1928	12821-90002		
105102	2607 LINE PRINTER	4K	24340-16001	1446	12987-90004		
145103	2613/17/18 LINE PRINTER	4K	02618-16001	1633	02618-90006		
105106	2631 PRINTER	8K	02631-16001	1913	02631-90906	24998-13304	2026
105107	2635 PRINTING TERMINAL	8K	02635-16001	1913	02631-90906		
105105	2608 LINE PRINTER	8K	02608-16001	2026	02608-90906		
105104	9866 LINE PRINTER	4K	12996-16001	1541	12996-90001		
111104	12732 FLEXIBLE DISC SUBSYSTEM	8K	12732-16003	1708	12732-90003		
151302	7900/01 CARTRIDGE DISC	8K	12960-16001	1805	12960-90003	24998-13305	1822
151403	7905/06/20/25 DISC	16K	12962-16001	1805	12962-90001		
104117	92900 TERMINAL SUBSYS (3070,40280)	8K	92900-16001	1814	92900-90003		
112200	9-TRACK MAG TAPE (7970, 13181/3)	8K	13181-16001	2040	13181-90095		
146200	PAPER TAPE READER-PUNCH	4K	12597-16001	1725	12597-90031		
113100	2892 CARD READER	4K	12924-16001	1537	12924-90006	24998-13306	2040
010000	DIAGNOSTIC CROSS LINK	4K	24296-16003	1627	02100-90157		
011000	7900/05/20 DISC INITIALIZATION	4K	24296-16002	1627	02100-90157		

Note: Part no. 24998-14002 consists of the 6 cartridge tapes 24998-13301, 24998-13302, 24998-13303, 24998-13304, 24998-13305 and 24998-13306.

*The diagnostics and control programs listed in this reference table are stored on the appropriate media in the sequence specified by the table. This does not imply that a specific system delivered to a user is compatible with all the hardware listed in this table.

Appendix B
Configurator Halt Code Summary

HALT CODE	REASON/RESPONSE
102000	Manual Configuration was selected (S-REG originally cleared). The program is requesting the computer type and options. The program calculated type and options are stored in the A-REG and S-REG (S-REG only if the computer being used is a HP 21MX, 2100A/S or 2114A/B). Refer to Figure 3-4 and Chapter 3 and if necessary, change the S-REG to the correct, or desired value and press RUN.
102001	Manual Configuration was selected (S-REG originally cleared). The program is requesting the console interface type and select code. The A-REG and S-REG are cleared by the program prior to the halt. Refer to Figure 2-6 for the correct bit setting, set the S-REG accordingly and press RUN. If no console device is available, ensure that the S-REG is cleared and then press RUN.
102002	Manual Configuration was selected (S-REG originally cleared). The progrm is requesting the line printer type and select code. The A-REG and S-REG are cleared prior to the halt. Refer to Figure 2-6 for the correct bit setting, set the S-REG accordingly and press RUN. If no line printer is available, ensure that the S-REG is cleared then press RUN.
102003	Manual Configuration was selected (S-REG originally cleared). The program is requesting the memory size. The program calculated size is stored in the A-REG and S-REG (S-REG only if the computer being used is a 21MX, 2100A/S or 2114A/B). Refer to Figure 3-5 and Chapter 3 and if necessary, change the S-REG to correct or desired value then press RUN.
102004	Manual Configuration was selected (S-REG originally cleared). The program is requesting the diagnostic input device type and select code. The A-REG and S-REG are cleared by the program prior to the halt. Refer to Figure 2-6 for the correct bit setting, set the S-REG accordingly, then press RUN.

HALT CODE	REASON/RESPONSE
102010	Illegal select code (<10) for diagnostic input device or console was chosen. Restart at P = 100 for configuration or P = 2 for Pretest. (If halt occurs during disc initialization, there was no console specified and the program cannot be run.)
102011	Checksum error during the loading of a binary file.
102020	Pretest halt for 2115 or 2116 computer. Set S-REG to 177777 and press RUN.
102021	Pretest halt for 2115 or 2116 computer. Clear S-REG and press RUN.
102022	Conversational or Automatic Configuration was selected and the console interface type could not be determined by the configurator from the select code input to the S-REG.
102022	Conversational or Automatic Configuration was selected and the console interface type could not be determined by the configurator from the select code input to the S-REG. Check the S-REG for the correct select code: a. Change it if incorrect, then press RUN. b. If the select code is correct, check the interface type. If it is not a 12531, 12880, 12587, 12966 or 12968, no driver is available and no console can be specified. c. If the select code and type are correct there is a possible problem on the interface board and the Manual Configuration must be used. The diagnostic for the console or interface should be run.
102033	The disc boot has been loaded and executed. During execution the boot could not find the DMA/DCPC control word in upper memory (for the select code). Load A-REG bits 5-0 with the disc select code and press RUN.
102044	Disc did not respond with a flag. Restart program.

HALT CODE	REASON/RESPONSE
102045	Disc not ready or a hardware failure has occurred. Press RUN to try operation again.
102055	Address violation during the loading of a binary file.
102066	Pretest failed. Refer to M-REG for memory location in Pretest and Appendix D for program listing.
102071	Manual Configuration was selected (S-REG originally cleared) and the console type input by the operator was not valid. a. To leave a pseudo-driver in place, press RUN or b. Restart configuration
102072	An invalid loader type has been specified during configuration. a. Press RUN to leave a pseudo-loader in the driver area or b. Restart configuration
102073	CS/80 driver failed to get a valid Describe Response. Restart and check your answers.
102077	End-of-operation a. Disc Boot b. Disc Initialization c. Paper Tape Dump d. Load Complete e. Configuration Complete (Manual) f. Pretest Complete
103033	CS/80 boot with bit 3 = 0 and no "other" system on the device. Reboot with bits set in switch register.

HALT CODE	REASON/RESPONSE
106070	"End-of-Files" was reached during a diagnostic load operation. The specified DSN was not found. If a different diagnostic(s) selection on the current tape is desired: a. Load the A-REG with a new DSN. b. Clear the B-REG if sequential execution is not desired, otherwise set B-REG to appropriate sequential selection. c. Ready input device, set P-REG = 120, press PRETEST and RUN. If the diagnostic(s) originally selected is on a different tape: a. Load the new tape. (If a 2644/45 cartridge tape, manually file forward over the configurator.) b. If sequential execution was selected (B = 0) set P-REG = N6500. c. Ready input device, press PRETEST and RUN.
106071*	No console was specified during configuration. A pseudo-driver was configured in place of the console driver and a request for input from the console was generated by the diagnostic. Press RUN to return to the program--but it should be noted that the request is in error. The program should check for the presence of a console (address 114 = SC of the console) before making a request.
106072*	No diagnostic input device was specified during Manual or Automatic configuration. A pseudo-driver was configured in place of the diagnostic input device driver and a request for input was generated by the diagnostic or the operator. No loading is possible.
106073*	This halt has two meanings as follows: a. During a transfer using the I/O processor loader link, an error was encountered. Restart the loader program in the I/O processor. b. The diagnostic memory size exceeded the available space. (Refer to Chapter 2.)

* These halts can occur during diagnostic execution.

HALT CODE	REASON/RESPONSE
106074*	Error on diagnostic input device (paper tape, magnetic tape, cartridge tape, or disc): a. Device not ready; ready device: Press RUN. b. Time-out on long paper tape leader: Press RUN. c. Incorrect SC or device type specified: Reconfigure Configurator. d. Data error on device: Restart loader in Configurator by setting P = 120, A-REG to DSN, and B-REG to serial execution.
106075*	All unused memory locations in the first 4K are loaded with halts 106075.
106076*	An output request to the line printer has been generated and the line printer was not ready. Ready the line printer and press RUN.
106077*	Trap cell halt. M-REG = trap cell address.

* These halts can occur during diagnostic execution.

Appendix C
Operator's Notes

General

Appendix C is divided into five basic sections:

1. Figure C-1 gives the operator the basic instructions to transfer the Configurator and diagnostic(s) and/or control programs from one medium to another. It is a general guide to lead the user to the appropriate area in this manual (in case of paper tape dump or disc initialization), or to an operating system.

2. Magnetic tape and cartridge tape format required by basic loader and loader in Configurator.

3. Cartridge Disc Initialization for HP 7900/7901, HP 7905 and HP 7920.

4. Cross Link for program down-loading from a second computer in a multicomputer system.

5. CS/80 Media Initialization.

Magnetic Tape and Cartridge Tape Format

To facilitate the use of magnetic tape and cartridge tape, input drivers were added to the Configurator. This allows the operator to boot-in the Configurator, then load diagnostics using the Configurator driver. The Configurator, diagnostics, and control programs are in absolute binary format and the last file is followed by a second EOF record. To create a magnetic tape, the operator must use RTE or DOS to write the absolute binary programs onto magnetic tape. To create a cartridge tape, the operator must use RTE. Refer to Figure C-2 for the format used on magnetic tape and cartridge tape.

LOAD CONFIGURATOR, DIAGNOSTICS AND/OR CONTROL PROGRAM(S) FROM:	IF IT IS DESIRED TO TRANSFER THE CONFIGURATOR, DIAGNOSTIC(S), AND/OR CONTROL PROGRAMS TO:		
	PAPER TAPE	7970 MAG TAPE (9-TRACK) OR 2644/45 CARTRIDGE TAPE	7900/01 DISC 7905 DISC
Paper Tape	Use Paper Tape Dump routine in Configurator; load Configurator and diagnostic from tape and create a memory dump of: a. Configured Configurator - or b. Configured Configurator and unconfigured diagnostic - or - c. Configured Configurator and configured diagnostic.	Not possible with Configurator. Use DOS or RTE to transfer the absolute binary diagnostics onto magnetic tape or RTE to transfer the binary onto cartridge tape.	Use Disc Initialization Program to create a diagnostic disc with Configurator
7970 Mag Tape (9-track) or 2644/45 Cartridge Tape	Not possible with Configurator. Use DOS or RTE System for magnetic tape; use RTE System for cartridge tape.		
7900/01 Disc 7905 Disc 7920 Disc			
CS/80 Device	RTE-6/VM (or RTE-A if non-disc)		

Figure C-1. Program Transfer Guide

Cartridge Disc Initialization (Non-CS/80)

General

The Cartridge Disc Initialization program is used to write first the Configurator, then Diagnostics and/or Control Programs on an HP 7900/01/05, or HP 7920 Cartridge Disc. After the Cartridge Disc has been initialized, the operator uses the Disc Loader (IBL or BMDL) to load the Configurator, then the Configurator is configured and used to load programs specified by a DSN from the disc.

The Disc Initialization program allows either the Configurator, diagnostics, and control programs to be co-resident on a disc with an RTE or DOLS Operating System or have a disc entirely dedicated to diagnostics programs. When using the Disc Loader, the operator can specify via S-Register bit 3 to load either the Configurator (bit 3 set) or the system boot (bit 3 cleared), provided a system was on the disc prior to initialization. Disc Initialization requires continuous tracks on the disc. Track sparing is not employed by Disc Initialization. If diagnostics are co-resident with a system, the system cannot do track sparing in the area where the diagnostics will be stored.

Required Hardware

The following hardware is required:

a. An HP 2100 series computer with at least 4K of memory.

b. An HP 7900/01/05, or HP 7920 Cartridge Disc. (Only computer type and cartridge disc type combinations specified by the appropriate hardware manuals are allowed to run Disc Initialization. The disc platter must be formatted and track sparing cannot be used. It cannot be the same physical disc as specified in Appendix C.)

c. A console device for operator communication is required. The interface must be an HP 12531B/C/D, 12880A, 12587B, 12966A, or 12968A.

d. A program input device as specified in Chapter 1.

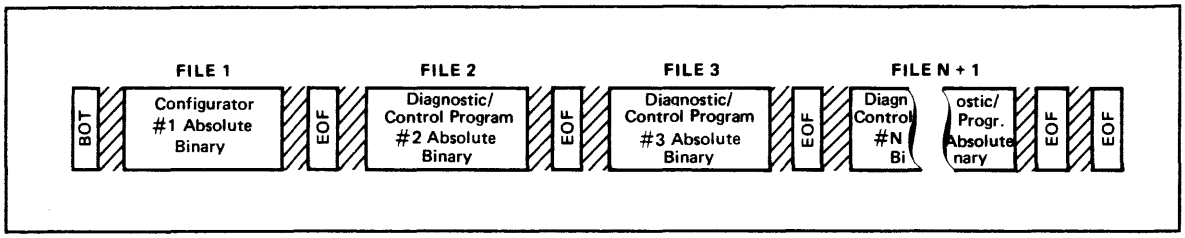


Figure C-2. Magnetic Tape and Cartridge Tape Format

Required Software

In addition to the Configurator and the programs to be loaded onto the disc, the Disc Initialization (part no. 24296-16002), is required.

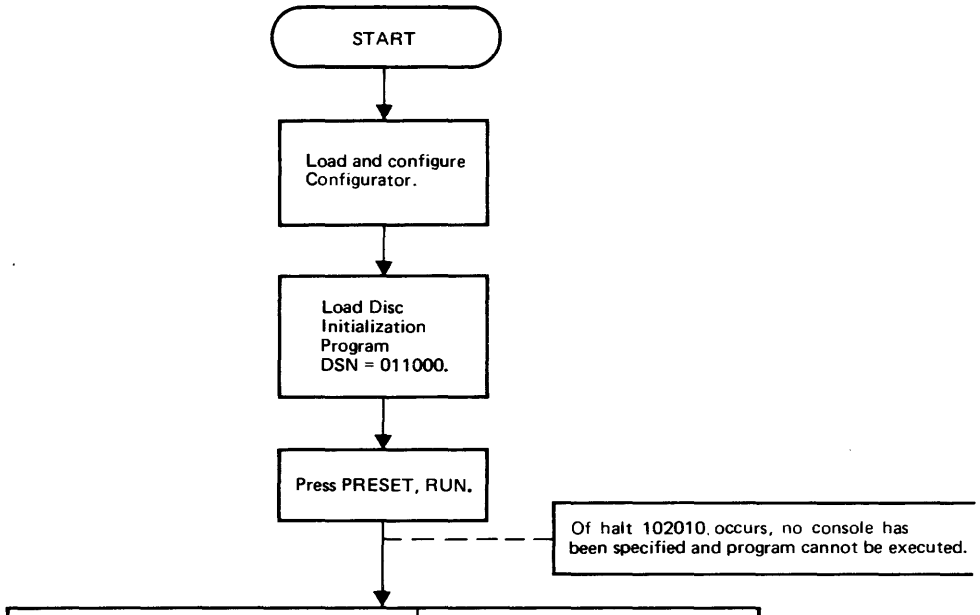
Operating Procedure

The operating procedures for Disc Initialization are outlined in Figure C-3.

When the Disc Initialization program is executed it reads into memory cylinder 0, head 0, sector 0 where the system boot is located if the disc carries an operating system. It then copies data necessary for DOS IIIB, then it saves the data so that the boot will operate with DOS IIIB.

After the Configurator has been loaded and configured, and the Disc Initialization has been loaded with the help of the Configurator, the program (when executed) writes a title message and asks the operator to input the disc type and SC followed by the first and last cylinder number. The numbers entered are first checked to ensure that the first cylinder number is smaller than the second and that the second cylinder number is not greater than 202 for 7900/01 or 410 for 7905/20. If either of the above conditions exists, the question is repeated. The Configurator loader routine is then written on the disc in the first cylinder specified by the operator. If the boot on the disc is not the original system boot but a previous Configurator boot, the program reads the original system boot from its previous location. The system boot is then written on the disc in the same cylinder as the loading routine.

The operator is then asked for the input device to be used. When the device is ready, the routine copies all files from the input device to the disc. The files must contain records of 60 words or less and be in absolute binary format. The files are stored consecutively until all files have been copied from the input device. At this point the operator is asked "END OF FILES?". If more file are to be loaded from the same input device, the operator answers "NO". If the entire file loading process is completed, the disc is ready to be employed as a diagnostic input device and the operator answers "YES" to terminate the disc initialization. If "RUN" is pressed after halt 102077, the program will restart.


START
Load and configure Configurator.
Load Disc Initialization Program DSN = 011000.
Press PRESET, RUN.
Of halt 102010 occurs, no console has been specified and program cannot be executed.

MESSAGES PRINTED ON THE CONSOLE:	OPERATOR RESPONSE:
CARTRIDGE DISC INITIALIZATION	None (information only)
DISC DEVICE (NO., SC)	xxxx,sc (note 1)
FIRST, LAST CYLINDER NUMBER .	fff,lll (note 2)
INPUT DEVICE (NO., SC)	nnnn, sc (note 3)
READY INPUT DEVICE, PRESS RETURN	(Press return when ready) (note 4)
END OF LOAD?	NO (note 5); YES (note 6)
POSSIBLE ERROR MESSAGES	
CHECKSUM ERROR, ABORT?	NO (continue loading current file) YES (go to END OF LOAD?)
OVER LAST CYLINDER, ABORTED!!	None (program restarts)

Remarks:
If a halt 102044 occurs,the disc did not respond with a flag.
If a halt 102045 occurs, the disc is not ready or has a hardware fault.

NOTES:
1. Respond with appropriate disc model number and lower SC (higher priority). XXXX = 7900, 7901, or 7905.
2. Respond with cylinder number on disc to be used for program storage.
3. Respond with the appropriate device number (or two letters) and select code.

nnn	=	2737, 2748 or 2758	Paper tape devices
	=	7970	Mag tape (9 - track only, Unit 0 only)
	=	7900 or 7901	Cartridge disc (removable platter only)
	=	7905	Cartridge disc (removable platter, upper surface)
	=	7920	Cartridge disc (upper surface)
	=	2644 or 2645	Cartridge tape
SC	=	select code of device	(Lower SC in case of 2 SC)

4. All binary files will be transfered from specified input device to disc until double end of files or end of tape is reached. The Configurator must be first file loaded.
5. Respond with "NO" to continue loading more files from specified input device after input device has been readied.
6. Respond with "YES" if end of load operation.

Figure C-3. Disc Initialization Flowchart

Cartridge Disc Format (Non-CS/80)

The first cylinder specified by the operator contains the original system boot and the Configurator loading routine. These are memory image formats. The Configurator (which must be loaded first), diagnostics, and/or control programs start on the next sequential cylinder and are in absolute binary format with the exception of the first three words. Each file starts on a sector boundary and the first three words contain the following:

a. Word 1 = the cylinder number of the next consecutive file.

b. Word 2 = the head and the sector of the next consecutive file.

c. Word 3 = the negative of the highest memory address location used by the file.

The last file is an end of files mark where:

a. Word 1 = all one's.

b. Word 2 = all zero's.

c. Word 3 = all zero's.

Disc Initialization Example

The system configuration is used for the following Disc Initialization example:

a. HP 21MX Computer with DMA, MPRT, and 32K memory

b. Console in select code 12

c. Paper tape reader in select code 13

d. HP 7900A Disc in select code 15

e. HP 7970B Magnetic Tape Unit in select code 21

Initialize a cartridge disc using magnetic tape as a source for the binary files. The cartridge disc can:

a. Be blank (but must be formatted),

b. Have a system on it with a reserved area set aside when the system was generated, or

c. Have a system on it with an area set aside in the file area on disc. This area, once initialized, cannot be moved (example PK command). Therefore, it should be the first area in the directory. The area can be set aside by the ST,B command for DOS or the CR command for RTE. (A directory list will give the starting cylinder of the file.)

After the Disc Initialization program has been loaded by the Configurator and started at location 100, the following messages appear on the terminal:

```
CARTRIDGE DISC INITIALIZATION

DISC DEVICE (NO.,SC).....7900,15

FIRST, LAST CYLINDER NUMBERS.0,40 (blank disc or the area set aside)

INPUT DEVICE (NO.,SC)..7920,21

READY INPUT DEVICE, PRESS RETURN
```

At this point the program loads the binary files sequentially from magnetic tape. When the transfer is complete, the program will output the message "END OF LOAD?". If more files are to be loaded from the same device, answer "NO". If all files are loaded and the cartridge is ready, answer "YES".

Cross Link

General

Cross Link is used in a multicomputer environment where one computer is designated as a central processor and all others are I/O (slave) processors. It is used to load the Configurator, diagnostics, and control programs from the central processor to an I/O processor through one of three possible links:

a. HP 12875 Processor Interconnect. (Four 12566 interfaces; Cross Link utilizes one 12566 processor interconnect pair.)

b. HP 12665 Computer Serial Interface Kit.

c. HP 12773 Computer Modem Interface Kit.

The two interface kits have the same program control. The differences are that the 12665 is hardwired and the 12773 is modem connected.

The program is useful when the I/O processor has one of the two links to the central processor but no input device and/or no console and/or no line printer attached, and a diagnostic has to be loaded and executed in the I/O processor. This does not imply that all three peripheral devices have to be attached to the central processor. However, when any one of the devices are attached to the central processor, Cross Link must be loaded and execution started in the central processor so that the linkage for that device can be established in the I/O processor.

All drivers (input device, console, and line printer) which have been loaded as part of the Configurator will be configured to the peripherals in the central processor. The Cross Link program, which then is loaded, will link the drivers via link routines from the central processor to the I/O processor. This feature gives the user the capability to load a program (diagnostic) from the input device via the input device link on the main processor through the input device coupler driver in the I/O processor into the I/O processor memory. Then he starts program execution in the I/O processor. Message reporting to the console is done via the console driver in the I/O processor, the console link and console driver in the central processor, and to the attached console. See Figure C-4.

The Cross Link program does require the full dedication of the central processor because it is a standalone program. It is not possible to initialize a disc through Cross Link.

Required Hardware

The following hardware is required:

a. Two or more 2100 series computers, each with at least 4K of memory.

b. HP 12875 Processor Interconnect or HP 12665/12773 Computer Serial Interface. (Only computer type and Processor Interconnect combinations or computer type and Serial Interface combinations specified by the appropriate hardware manuals are allowed.)

c. A console device for operator communication is optional. See Chapter 1.

d. A program input device as specified in Chapter 1.

Required Software

In addition to the Configurator and the programs to be cross-loaded to the I/O processor, the Diagnostic Cross Link, part no. 24296-16003, is required.

Operating Procedures

The operating procedures for Cross Link are outlined in Figure C-5. To execute the Cross Link program, the operator must first load and configure the Configurator in the central processor to the input device and/or console and/or line printer type and SC's, then load the Cross Link program with the Configurator. In S-Register bits 0-8, specify the link interface type and select codes and with S-Register bits 12-14, specify which drivers (input device, line printer, console) are to be used in the I/O processor. After pressing RUN on the central processor, the program instructs the operator to start the special binary loader* in the I/O processor to load the Configurator from the input device via the central processor to the I/O processor. When the Configurator is loaded, the Cross Link loads the couplers which were specified by the operator. It should be noted that the Cross Link program sets a flag in the I/O processor memory so that, when the Configurator in the I/O processor is configured, the program will use the console coupler (unless overridden by Manual Configuration). The input device coupler SC must be specified as the diagnostic input device during configuration of the Configurator. In case of a line printer, the first coupler SC must be specified.

* Special binary loader: For 12875 Processor Interconnect, standard Paper Tape Loader is employed to cross link.
For 12665/12773 Computer Interface Kit, SCE1 Loader Program (part no. 91700-16160), Rev. 1621, or equivalent ROM.

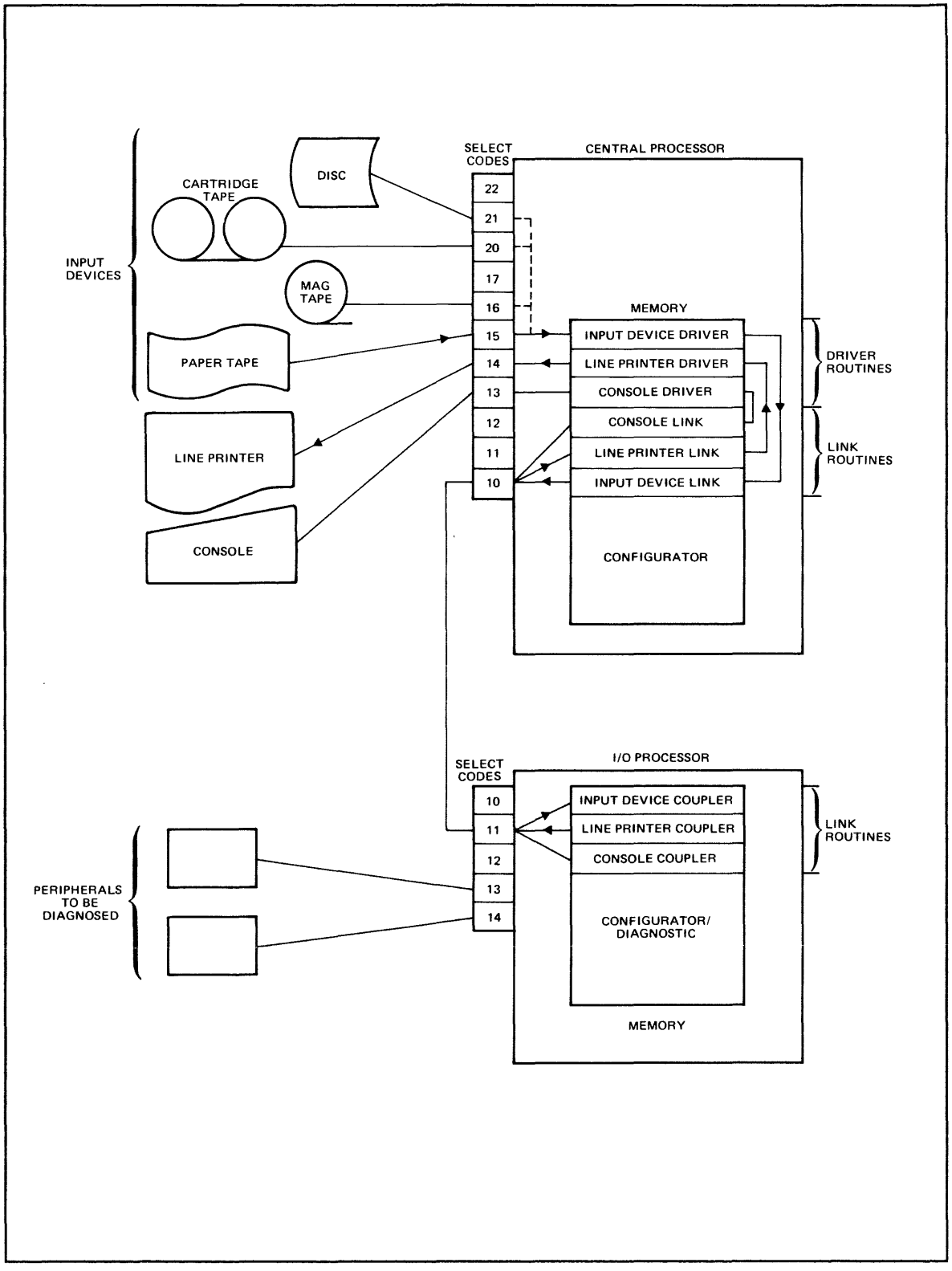


Figure C-4. Dual Computer Link

CS/80 Medium Initialization

General

The CS/80 device is initialized in an RTE environment. The RTE-A system cannot be used to initialize a CS/80 disc, but it can be used to initialize a CS/80 CTU. The CS/80 initialization program allows either the Configurator, diagnostics, and control programs to be co-resident on a disc with an RTE-6/VM system or to have the disc entirely dedicated to diagnostic programs. The CS/80 CTU may also contain other data, however, a bootstrap loader is required in block 0 on the tape. Blocks 1 through n-1 are available for other data (see below for a definition of n). Initialization is done by the program CS/80BD.

Required Hardware and Software

Minimum system is: RTE-6/VM Rev. 2440 or later
or RTE-A Rev. 2440 or later

CS/80BD requires a CS/80 device LU which points at DD.33 (RTE-A) or DVM33 or DVN33 (RTE-VI). Further, if a disc is to be initialized the LU must reference a logical disc which starts at block 0 on the physical disc.

The CI file system must also be installed.

Format of the CS/80 Medium

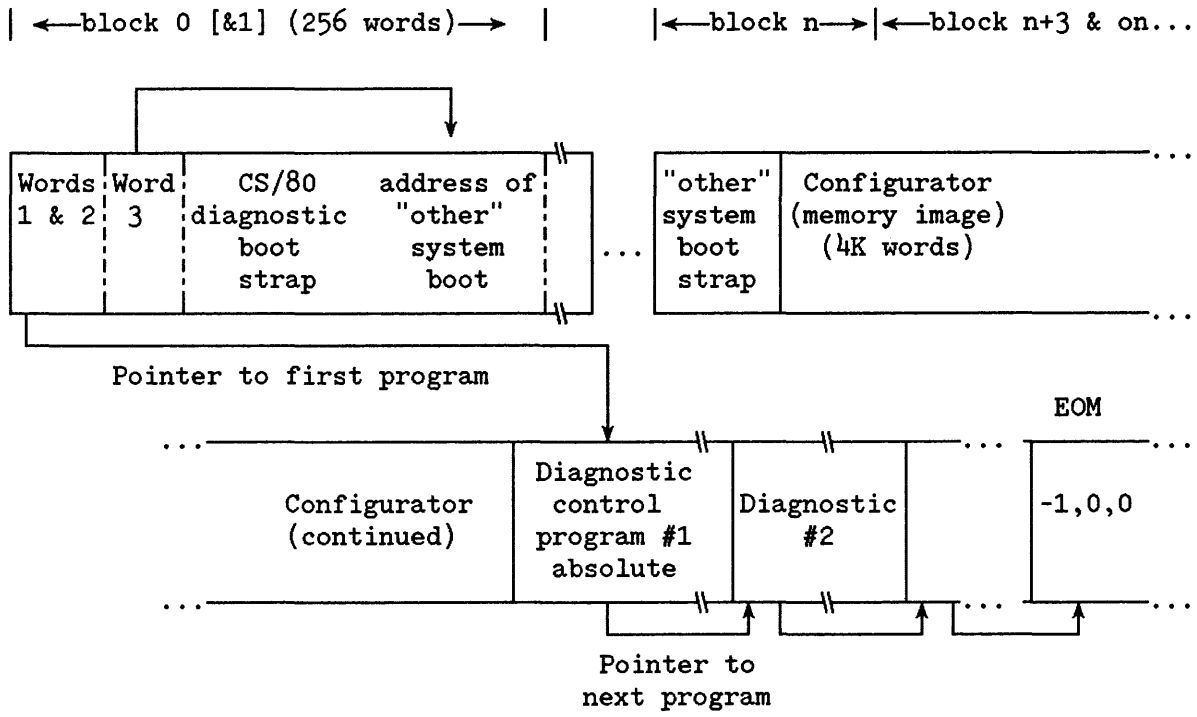
A CS/80 device is formatted into a string of consecutive blocks of data. Each block contains 128 x M words of data. For the disc M is 1 and for the CTU M is 4. The CONFIGURATOR obtains M by doing a CS/80 'DESCRIBE' call.

Block 0 will always contain the Diagnostic boot strap. This code, when brought into memory by the CS/80 boot ROM, reads either the saved 'other' system boot strap (S-Register bit 3 = 0) or the Configurator (S-Register bit 3 = 1) into memory and transfers control to it. The first two words of block 0 contain the block number of the first block of the first diagnostic control program. Word 3 of block 0 is defined by the CS/80 boot strap and points to the location in the boot of the double word CS/80 block address of the 'other' system boot strap. This block address is set by CS/80BD when it initializes the medium. Each control program starts on a block boundry and is preceded by three words as follows:

a. Words 1 and 2 = the double word block address of the next control block.

b. Word 3 = The negative of the highest memory address used by this file.

The last file is an end of medium (EOM) mark and is three words as follows: -1,0,0.



Preparation for Running CS/80BD

CS/80BD builds the required file structure from a series of absolute files. You will need absolute files for all the diagnostics you want to load plus:

a. The CS/80 diagnostic boot strap !C80BX (part no. 24396-16002)

b. The Diagnostic Configurator !DGCNF (part no. 24296-60001)

In addition, you should load the CS/80BD program (part no. 24396-16002) using the #CS/80BD control file (part no. 24396-17001).

CS/80BD runs exclusively from a command file. This file must contain a list of the file names of all the absolute diagnostic programs. The first file name must be the TEMP file name to use. It must be type one. This is the file that is built in phase one and read in phase two. The second file name must be the CS/80 diagnostic boot strap and the third file name must be for the Diagnostic Configurator. Additional files should be for the diagnostic programs and should be in ascending DSN order.

Running CS/80BD

To build a CS/80 Diagnostic Configurator tape or disc.

RU,CS80B, command file,<CS80 LU>,first block #,last block #

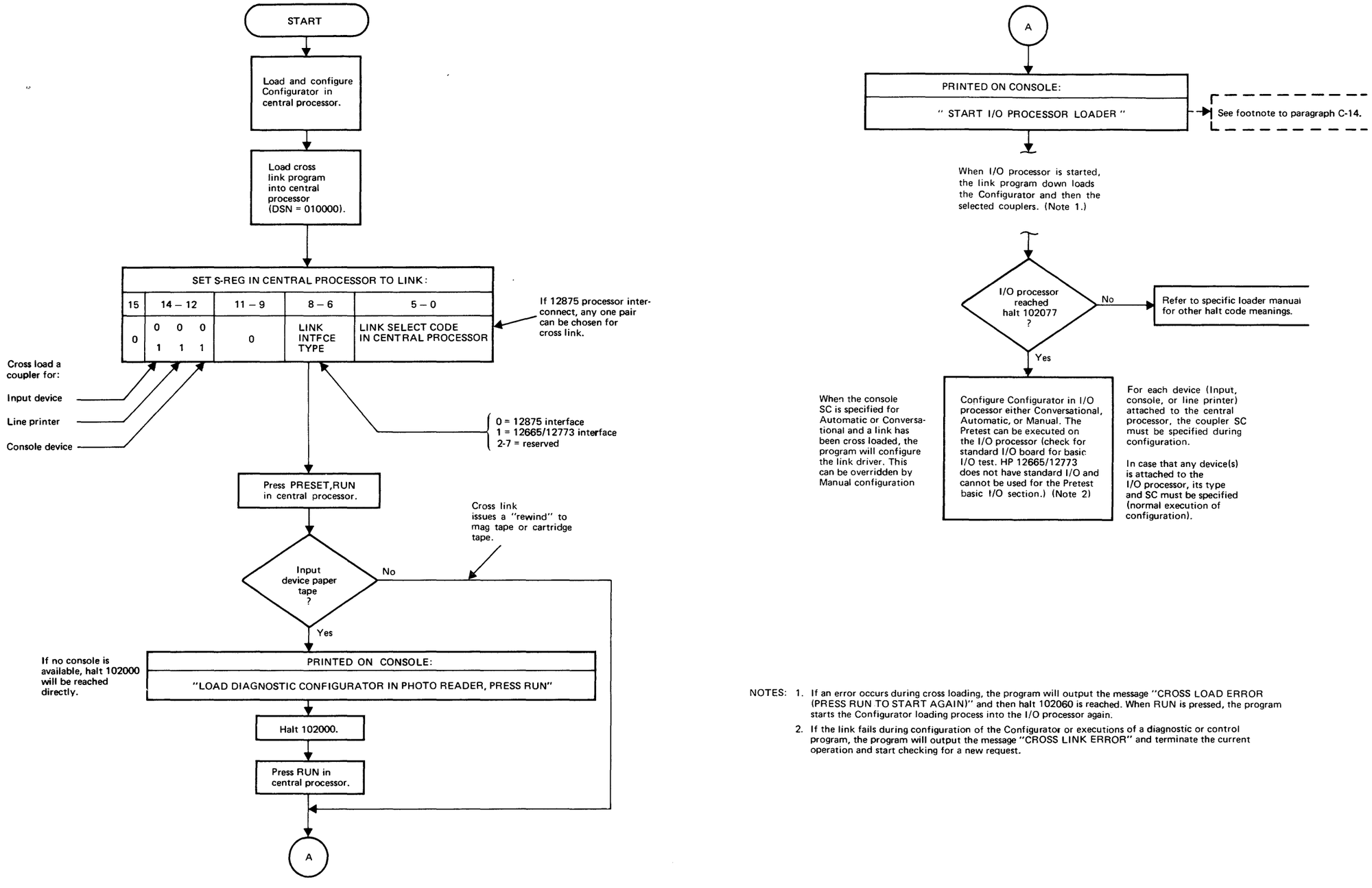
where:

command file	is a file of file names or is a type 1 file built by this program
<CS80 LU>	is the CS/80 device LU or is 0 if to build the type 1 file only
first block #	is the first device block to use
last block #	is the last CS/80 device block to use if negative, as much as needed. (If CS/80 LU is 0 the first and last block not needed.)

Note that "first block" allows you to skip over a co-resident system.

CS/80BD has two phases or passes. In pass one it processes each file and builds a temp file that contains an image close to the final format. In pass two it writes the CS/80 files, updating pointers and saving the current "other" system boot strap. If the current boot strap is a Diagnostic boot strap it will be used to find the old "other" system boot strap. If a CTU is being initialized or if a valid boot strap is not found a dummy "other" system boot strap is used. This dummy boot strap consists of 103033 halts.

The program will terminate at the end of a phase one if no CS/80 LU is given in the run string. Likewise, if a output file from this program is given for the command file, it will skip phase one and immediately translate the file to the CS/80 device.


START
Load and configure Configurator in central processor.
Load cross link program into central processor (DSN = 010000).
SET S-REG IN CENTRAL PROCESSOR TO LINK:
15
14 – 12
11 – 9
8 – 6
5 – 0
0
0 0 0
1 1 1
0
LINK INTFCE TYPE
LINK SELECT CODE IN CENTRAL PROCESSOR
If 12875 processor interconnect, any one pair can be chosen for cross link.
Cross load a coupler for:
Input device
Line printer
Console device
0 = 12875 interface
1 = 12665/12773 interface
2-7 = reserved
Press PRESET,RUN in central processor.
Cross link issues a "rewind" to mag tape or cartridge tape.
Input device paper tape ?
No
Yes
If no console is available, halt 102000 will be reached directly.
PRINTED ON CONSOLE:
"LOAD DIAGNOSTIC CONFIGURATOR IN PHOTO READER, PRESS RUN"
Halt 102000.
Press RUN in central processor.
A
A
PRINTED ON CONSOLE:
" START I/O PROCESSOR LOADER "
See footnote to paragraph C-14.
When I/O processor is started, the link program down loads the Configurator and then the selected couplers. (Note 1.)
I/O processor reached halt 102077 ?
No
Refer to specific loader manual for other halt code meanings.
Yes
When the console SC is specified for Automatic or Conversational and a link has been cross loaded, the program will configure the link driver. This can be overridden by Manual configuration
Configure Configurator in I/O processor either Conversational, Automatic, or Manual. The Pretest can be executed on the I/O processor (check for standard I/O board for basic I/O test. HP 12665/12773 does not have standard I/O and cannot be used for the Pretest basic I/O section.) (Note 2)
For each device (Input, console, or line printer) attached to the central processor, the coupler SC must be specified during configuration.
In case that any device(s) is attached to the I/O processor, its type and SC must be specified (normal execution of configuration).

NOTES:
1. If an error occurs during cross loading, the program will output the message "CROSS LOAD ERROR (PRESS RUN TO START AGAIN)" and then halt 102060 is reached. When RUN is pressed, the program starts the Configurator loading process into the I/O processor again.
2. If the link fails during configuration of the Configurator or executions of a diagnostic or control program, the program will output the message "CROSS LINK ERROR" and terminate the current operation and start checking for a new request.

Figure C-5. Cross Link Flowchart

Appendix D
Pretest Source Listing

```
00003  00002                ORG 2
00004*
00005*       VERSION OF REV.2522  <850523.1632>
00006*
00007*       SOURCE:   24296-80001
00008*       ABSOLUTE: 24296-60001
00009*       MANUAL:   02100-90157
00010                      SUP
00011         000000  A     EQU 0
00012         000001  B     EQU 1
00013         000000  SC    EQU 0
00014         000000  INTP  EQU 0
00015         000001  SWREG EQU 1
00016         000002  DMA2  EQU 2
00017         000006  DMA6  EQU 6
00018         000005  MPRT  EQU 5
00019  00002 000130          JMP 130B      GO TO START OF PRETEST
00020                        REP 60
00021  00003 106077          OCT 106077
00022  00077 000077  CSUNIT JMP *          SET BY BOOT AND/OR CONFIG. BITS 8-10
00023*                                       THIS VALUE IS 0 IN THOSE BITS
00024*
00025*          LINK TABLE
00026*
00027  00100 001412  START JMP CFIG,I     GO DIRECT TO CONFIGURATION
00028  00101 007431  DRI   DEF LDVR       DATA RECORD INPUT
00029  00102 007327  COD   DEF CNSLO      CONSOLE OUTPUT DRIVER
00030  00103 007404  LPD   DEF LNPTR      LINE PRINTER DRIVER
00031  00104 007354  CID   DEF CNSLI      CONSOLE INPUT DRIVER
00032  00105 000130  FWA   OCT 130         FIRST WORD OF AVBL. MEMORY
00033  00106 006477  LWA   DEF LWAA       LAST WORD OF AVBL. MEMORY
00034  00107 007167  DLP   DEF LOAD       DIAG. LOADER PROGRAM
00035  00110 177404        DEC -252       1 MILSEC. TIME COUNT
00036  00111 000000  DRISC OCT 0          DATA RECORD INPUT SELECT CODE
00037  00112 000000  CODSC OCT 0          CONSOLE OUTPUT SELECT CODE
00038  00113 000000  LPDSC OCT 0          LINE PRINTER SELECT CODE
00039  00114 000000  CIDSC OCT 0          CONSOLE INPUT SELECT CODE
00040*
00041*     CPU TYPE AND OPTIONS WORD FORMAT
00042*
00043*     BIT  MASK  MEANING IF SET (=1)
00044*     0    1     POWER FAIL AUTO RESTART
00045*     1    2     EAU INSTALLED
00046*     2    4     DMA PRESENT
00047*     3    10    CENTRAL INTERRUPT REG.
00048*     4    20    MEMORY PARITY
00049*     5    40    MP INSTALLED
00050*     6    100   FLOATING POINT
00051*     7    200   DMA 1 CHANNEL ONLY (2114)
00052*     8    400   <NOT USED>
00053*     9    1000  <NOT USED>
00054*     10   2000  <NOT USED>
00055*     11   4000  <NOT USED>
00056*
```

```
00057*     HIGH BITS: (MASK=177000)
00058*     10K   2116A
00059*     20K   2116B
00060*     40K   2116C
00061*     50K   2114A
00062*     60K   2114B
00063*     70K   2100A/S
00064*    100K   21MX M
00065*    101K   21MX E
00066  00115 000000  CTO   NOP           COMPUTER TYPE/OPTIONS
00067  00116 000000        NOP           USER CARD TYPE AND SELECT CODE
00068  00117 000000  MEM   NOP           MEMORY SIZE
00069  00120 000107        JSB DLP,I     GO TO DIAG. LOADER PROGRAM
00070  00121 006730  WAIT  DEF TMR       1 MILL SEC TIMER ROUTINE
00071  00122 006722  SWRC  DEF SWR       CHECK SWITCH REG
00072  00123 006610  D2AS  DEF D2ASC     DECIMAL TO ASCII CONVERSION
00073  00124 006566  O2AS  DEF O2ASC     OCTAL TO ASCII CONVERSION
00074  00125 006653  AS2N  DEF ASC2N     ASCII TO BINARY CONVERSION
00075  00126 000200  DSN   OCT 000200    CONF. SERIAL NUMBER
00076  00127 006502  FMTO  DEF FMTR      FORMATTED OUTPUT
```

```
00078*     ONLY SINGLE OPERATION INSTRUCTIONS ARE TESTED.
00079*     IT IS ASSUMED THAT COMBINATIONS AFTER INITIAL
00080*     TEST WILL WORK(NOT NECESSARILY TRUE BUT NECESSARY).
00081*
00082*     INSTRUCTIONS ARE TESTED IN THE FOLLOWING SEQUENCE:
00083*
00084*     RSS  SOS  SOC  STO  CLO  CLE  SEZ  CCE  CME
00085*
00086*     CLA  CCA  CPA  SZA  STA  LDA  INA  CMA  SSA  SLA (B-REG INCLUSIVE)
00087*
00088*     STA B,I  STB A,I  LDA B,I  LDB A,I  CPA B,I  CPB A,I
00089*
00090*     JMP (BP)  JSB (BP)  JSB (BP),I TO (BP)
00091*
00092*     GENERAL MEMORY TEST (FIRST 4K ONLY)
00093*
00094*     AND  XOR  IOR  ISZ  ADA  ADB
00095*
00096*     MEMORY ADDRESS, PATTERN & WORST CASE TEST (ABOVE 4K ONLY)
00097*
00098*     CURRENT PAGE / BASE PAGE  JMP  LDA  STA  CPA  JSB
00099*
00100*     ALS  ARS  RAL  RAR  ALR  ALF  (BITS 8-6)
00101*
00102*     ALS  ARS  RAL  RAR  ALR  ALF  (BITS 2-0)
00103*
00104*     ELA  ERA  (BITS 8-6)  ELA  ERA  (BITS 2-0)
00105*
00106*
00107*     ANY ERROR ENCOUNTERED WILL BE INDICATED BY
00108*     A HALT 66B  (102066)
00109       000066  ERH   EQU 66B
00110*     REFER TO LISTING AT THE M-REG. ADDRESS FOR DETAILS IF
00111*     A HALT OCCURS.
00112*     FOR REFERENCES (BP) = BASE PAGE  AND (CP) = CURRENT PAGE




00114*     ARITHMETIC SETTING OF E & O REGISTERS (INA ADA  INB ADB)
00115*
00116*     EXTEND & OVERFLOW REGISTER RESULTS
00117*
00118*
00119*    AD* MEM  TO REG.   =     REG.   OVF  EXT
00120*         +       +           +      0    0
00121*         +       +           -      1    0
00122*         +       -           +      0    1
00123*         -       +           +      0    1
00124*         -       +           -      0    0
00125*         +       -           -      0    0
00126*         -       -           -      0    1
00127*         -       -           +      1    1
```

```
00129*                    PRE-TEST PART A (BP)
00130*
00131  00130 107700         CLC INTP,C     GENERATE CRS
00132  00131 002001         RSS
00133  00132 102066  HLTO   HLT ERH        RSS FAILED OR I/O CAUSED SKIP
00134*
00135  00133 001377         STA DISN       SAVE A-REG. FOR LATER
00136  00134 001400         STB DIBP       SAVE B-REG FOR LATER ALSO
00137  00135 002400         CLA
00138  00136 001401         STA SWRX       CLEAR S-REG. FLAG IF RESTART.
00139  00137 001402         STA BIOSC      CLEAR BASIC I/O SELECT CODE
00140*
00141  00140 102101  PTLP   STO            START HERE IF PRE TEST LOOP
00142  00141 102201         SOC
00143  00142 102301         SOS
00144  00143 102066         HLT ERH        STO / SOC / SOS
00145  00144 103101         CLO
00146  00145 102301         SOS
00147  00146 102201         SOC
00148  00147 102066         HLT ERH        CLO / SOS / SOC
00149  00150 000040         CLE
00150  00151 002041         SEZ,RSS
00151  00152 002040         SEZ
00152  00153 102066         HLT ERH        CLE / SEZ,RSS / SEZ
00153  00154 002300         CCE
00154  00155 002040         SEZ
00155  00156 002041         SEZ,RSS
00156  00157 102066         HLT ERH        CCE / SEZ / SEZ,RSS
00157  00160 002200         CME
00158  00161 002041         SEZ,RSS
00159  00162 002040         SEZ
00160  00163 102066         HLT ERH        CME / SEZ / SEZ,RSS
```

```
00162*                    PRE-TEST PART A (BP)
00163*
00164  00164 002400         CLA
00165  00165 007400         CCB
00166  00166 001371         STA TMPA
00167  00167 001372         STB TMPB
00168  00170 001335         CPA B0
00169  00171 002002         SZA
00170  00172 102066         HLT ERH        CLA/CPA/SZA
00171  00173 006002         SZB
00172  00174 001335         CPB B0
00173  00175 102066         HLT ERH        CCB/CPB/SZB
00174  00176 001363         CPA M1
00175  00177 102066         HLT ERH        CPA
00176  00200 001335         CPB B0
00177  00201 102066         HLT ERH        CPB
00178  00202 001372         LDA TMPB
00179  00203 001371         LDB TMPA
00180  00204 002002         SZA
00181  00205 001335         CPA B0
00182  00206 102066         HLT ERH        STB/LDA
00183  00207 001335         CPB B0
00184  00210 006002         SZB
00185  00211 102066         HLT ERH        STA/LDB
00186  00212 102301         SOS
00187  00213 002040         SEZ
00188  00214 102066         HLT ERH        E / O  SET
00189  00215 006004         INB
00190  00216 102301         SOS
00191  00217 002040         SEZ
00192  00220 102066         HLT ERH        E / O  SET
00193  00221 002004         INA
00194  00222 002040         SEZ
00195  00223 102201         SOC
00196  00224 102066         HLT ERH        E NOT SET / O SET
00197  00225 000040         CLE
00198  00226 006002         SZB
00199  00227 002002         SZA
00200  00230 102066         HLT ERH        INA/INB
00201  00231 001336         CPB B1
00202  00232 002001         RSS
00203  00233 102066         HLT ERH        INB
```

```
00205*                    PRE-TEST PART A (BP)
00206*
00207  00234 003400         CCA
00208  00235 006400         CLB
00209  00236 001371         STA TMPA
00210  00237 001372         STB TMPB
00211  00240 001363         CPA M1
00212  00241 002003         SZA,RSS
00213  00242 102066         HLT ERH        CCA/CPA/SZA,RSS
00214  00243 006003         SZB,RSS
00215  00244 001363         CPB M1
00216  00245 102066         HLT ERH        CLB/CPB/SZB,RSS
00217  00246 001335         CPA B0
00218  00247 102066         HLT ERH        CPA
00219  00250 001363         CPB M1
00220  00251 102066         HLT ERH        CPB
00221  00252 001372         LDA TMPB
00222  00253 001371         LDB TMPA
00223  00254 002003         SZA,RSS
00224  00255 001363         CPA M1
00225  00256 102066         HLT ERH        STB/LDA
00226  00257 001363         CPB M1
00227  00260 006003         SZB,RSS
00228  00261 102066         HLT ERH        STA/LDB
00229  00262 102301         SOS
00230  00263 002040         SEZ
00231  00264 102066         HLT ERH        E / O  SET
00232  00265 002004         INA
00233  00266 102301         SOS
00234  00267 002040         SEZ
00235  00270 102066         HLT ERH        E / O  SET
00236  00271 006004         INB
00237  00272 002040         SEZ
00238  00273 102201         SOC
00239  00274 102066         HLT ERH        E NOT SET / O SET
00240  00275 000040         CLE
00241  00276 006003         SZB,RSS
00242  00277 002003         SZA,RSS
00243  00300 102066         HLT ERH        INA/INB
00244  00301 001336         CPA B1
00245  00302 002001         RSS
00246  00303 102066         HLT ERH        INA
```

```
00248*                    PRE-TEST PART A (BP)
00249*
00250  00304 001406         LDA ALT0
00251  00305 001410         LDB ALT1
00252  00306 001371         STA TMPA
00253  00307 001372         STB TMPB
00254  00310 001406         CPA ALT0
00255  00311 002001         RSS
00256  00312 102066         HLT ERH        LDA/CPA
00257  00313 001410         CPB ALT1
00258  00314 002001         RSS
00259  00315 102066         HLT ERH        LDB/CPB
00260  00316 001372         LDA TMPB
00261  00317 001371         LDB TMPA
00262  00320 001410         CPA ALT1
00263  00321 002001         RSS
00264  00322 102066         HLT ERH        LDA/STB
00265  00323 001406         CPB ALT0
00266  00324 002001         RSS
00267  00325 102066         HLT ERH        LDB/STA
00268  00326 002004         INA
00269  00327 006004         INB
00270  00330 001411         CPA ALT1A
00271  00331 002001         RSS
00272  00332 102066         HLT ERH        INA
00273  00333 001407         CPB ALT0A
00274  00334 002001         RSS
00275  00335 102066         HLT ERH        INB
```

```
00277*                    PRE-TEST PART A (BP)
00278*
00279  00336 002400         CLA
00280  00337 007400         CCB
00281  00340 003000         CMA
00282  00341 007000         CMB
00283  00342 001363         CPA M1
00284  00343 006002         SZB
00285  00344 102066         HLT ERH        CMA / CMB
00286  00345 002020         SSA
00287  00346 006020         SSB
00288  00347 102066         HLT ERH        SSA / SSB
00289  00350 000010         SLA
00290  00351 004010         SLB
00291  00352 102066         HLT ERH        SLA / SLB
00292  00353 003000         CMA
00293  00354 007000         CMB
00294  00355 001363         CPB M1
00295  00356 002002         SZA
00296  00357 102066         HLT ERH        CMA / CMB
00297  00360 006020         SSB
00298  00361 002020         SSA
00299  00362 102066         HLT ERH        SSA / SSB
00300  00363 004010         SLB
00301  00364 000010         SLA
00302  00365 102066         HLT ERH        SLA / SLB
00303  00366 001406         LDA ALT0
00304  00367 001410         LDB ALT1
00305  00370 003000         CMA
00306  00371 007000         CMB
00307  00372 001410         CPA ALT1
00308  00373 002001         RSS
00309  00374 102066         HLT ERH        CMA
00310  00375 001406         CPB ALT0
00311  00376 002001         RSS
00312  00377 102066         HLT ERH        CMB
```

```
00314*                    PRE-TEST PART A (BP)
00315*
00316*      CHECK SWITCH REGISTER I/O
00317*
00318  00400 001401          LDA SWRX      CHECK IF SWREG HAS
00319  00401 002002          SZA             BEEN CHECK BEFORE
00320  00402 000452          JMP NXT00     YES SKIP CHECK
00321  00403 102501          LIA SWREG     GET AND
00322  00404 001401          STA SWRX        SAVE S-REG.
00323  00405 001406          LDA ALT0      TRY ALTERNATING PATTERNS
00324  00406 102601          OTA SWREG
00325  00407 102501          LIA SWREG
00326  00410 001401          CPA SWRX      STILL ORIGINAL?
00327  00411 001406          LDA ALT0      YES 2116/5 FORCE SKIP
00328  00412 001406          CPA ALT0
00329  00413 002001          RSS
00330  00414 102066          HLT ERH
00331  00415 001410          LDA ALT1      OTHER PATTERN
00332  00416 102601          OTA SWREG
00333  00417 102501          LIA SWREG
00334  00420 001401          CPA SWRX      STILL ORIGINAL?
00335  00421 001410          LDA ALT1      YES 2116/5 FORCE SKIP
00336  00422 001410          CPA ALT1
00337  00423 002001          RSS
00338  00424 102066          HLT ERH
00339  00425 003400          CCA           TRY OUTPUTING
00340  00426 102601          OTA SWREG     ALL ONE'S
00341  00427 102501          LIA SWREG     NOW GET IT BACK
00342  00430 001401          CPA SWRX      2115/2116?
00343  00431 000444          JMP *+11      OPERATOR MUST SET S-REG.
00344  00432 102501          LIA SWREG     GET IT AGAIN
00345  00433 001363          CPA M1        DID IT ECHO THE 1'S?
00346  00434 002001          RSS
00347  00435 102066          HLT ERH       NO
00348  00436 002400          CLA           TRY OUTPUTING
00349  00437 102601          OTA SWREG     BO  'S
00350  00440 102501          LIA SWREG     GET IT BACK
00351  00441 002002          SZA           OK
00352  00442 102066          HLT ERH       NO
00353  00443 000452          JMP NXT00     YES
00354  00444 102020          HLT 20B       2115/2116 OPERATOR MUST SET S-REG.
00355  00445 102501          LIA SWREG     GET IT
00356  00446 001363          CPA M1        IS IT ALL ONES
00357  00447 002001          RSS
00358  00450 102066          HLT ERH       NO INFORM OPERATOR
00359  00451 102021          HLT 21B       OPERATOR MUST CLEAR S-REG.
00360        000452  NXT00 EQU *
00361  00452 102501          LIA SWREG     GET IT AGAIN
00362  00453 002002          SZA           DID IT ECHO THE 0'S
00363  00454 102066          HLT ERH       NO
00364  00455 102301          SOS
00365  00456 002040          SEZ
00366  00457 102066          HLT ERH       E   O SET
```

```
00368*                    PRE-TEST PART A (BP)
00369*
00370  00460 001424         LDA DTMPB
00371  00461 001423         LDB DTMPA
00372  00462 000001         STA B,I
00373  00463 000000         STB A,I
00374  00464 001371         CPA TMPA
00375  00465 002001         RSS
00376  00466 102066         HLT ERH        STA B,I/STB A,I
00377  00467 001372         CPB TMPB
00378  00470 002001         RSS
00379  00471 102066         HLT ERH        STA B,I/STB A,I
00380  00472 000001         LDA B,I
00381  00473 000000         LDB A,I
00382  00474 001371         CPA TMPA
00383  00475 002001         RSS
00384  00476 102066         HLT ERH        LDA B,I
00385  00477 001372         CPB TMPB
00386  00500 002001         RSS
00387  00501 102066         HLT ERH        LDB A,I
00388  00502 000000         LDA A,I
00389  00503 000001         LDB B,I
00390  00504 000001         CPA B,I
00391  00505 002001         RSS
00392  00506 102066         HLT ERH        CPA B,I/LDA A,I
00393  00507 000000         CPB A,I
00394  00510 002001         RSS
00395  00511 102066         HLT ERH        CPB A,I/LDB B,I
```

```
00397*                    PRE-TEST PART A (BP)
00398*
00399  00512 000514         JMP *+2
00400  00513 102066         HLT ERH        JMP (BP)
00401  00514 000520         JMP *+4
00402  00515 102066         HLT ERH        JMP (BP)
00403  00516 000522         JMP *+4
00404  00517 102066         HLT ERH        JMP (BP)
00405  00520 000516         JMP *-2
00406  00521 102066         HLT ERH        JMP (BP)
00407*
00408  00522 002400         CLA
00409  00523 000531         STA JB0
00410  00524 000544         STA JB1
00411  00525 000132         LDA HLT0
00412  00526 000132         LDB HLT0
00413  00527 000531         JSB *+2
00414  00530 102066  JBR0   HLT ERH        JSB (BP)
00415  00531 000000  JB0    NOP
00416  00532 000531         LDA *-1
00417  00533 001427         CPA DJBR0
00418  00534 002001         RSS
00419  00535 102066         HLT ERH        JSB (BP)  RETURN ADDRESS
00420  00536 000132         LDA HLT0
00421  00537 000541         JSB *+2,I
00422  00540 102066  JBR1   HLT ERH        JSB (BP),I
00423  00541 000544         DEF *+3
00424  00542 102066         HLT ERH        JSB (BP),I
00425  00543 102066         HLT ERH        JSB (BP),I
00426  00544 000000  JB1    NOP
00427  00545 000544         LDA *-1
00428  00546 001430         CPA DJBR1
00429  00547 002001         RSS
00430  00550 102066         HLT ERH        JSB (BP),I  RETURN ADDRESS
```

```
00432*                    PRE-TEST PART A (BP)
00433*
00434*     GENERAL MEMORY TEST
00435*     COVERS 4K MEMORY (2 TO 7677)
00436*     EXCEPT THIS ROUTINE
00437*
00438         000551  GMTS  EQU *
00439   00551 006400        CLB           START WITH ADDRESS
00440   00552 006004        INB
00441   00553 006004        INB           TWO
00442   00554 000001  L00   LDA B,I       GET CURRENT CONTENTS
00443   00555 000001        CPA B,I       DID IT LOAD OK?
00444   00556 002001        RSS
00445   00557 102066        HLT ERH       NO FAILED ON LOAD
00446   00560 001371        STA TMPA      OK SAVE ORIGINAL CONTENTS
00447   00561 003400        CCA
00448   00562 000001        STA B,I       PUT ALL M1   IN LOCATION
00449   00563 000001        CPA B,I       DID IT STORE?
00450   00564 002001        RSS
00451   00565 102066        HLT ERH       NO FAILED ON STORE
00452   00566 002400        CLA           PUT  0   IN LOCATION
00453   00567 000001        STA B,I
00454   00570 000001        CPA B,I       DID IT STORE?
00455   00571 002001        RSS
00456   00572 102066        HLT ERH       NO FAILED ON STORE
00457   00573 001406        LDA ALT0      PUT ALTERNATING PATTERN IN LOACTION
00458   00574 000001        STA B,I
00459   00575 000001        CPA B,I       DID IT STORE?
00460   00576 002001        RSS
00461   00577 102066        HLT ERH       NO
00462   00600 001410        LDA ALT1      TRY OPPSITE PATTERN
00463   00601 000001        STA B,I
00464   00602 000001        CPA B,I       DID IT STORE?
00465   00603 002001        RSS
00466   00604 102066        HLT ERH       NO
00467   00605 001371        LDA TMPA      RESTORE ORIGINAL CONTENTS
00468   00606 000001        STA B,I
00469   00607 000001        CPA B,I       DID IT GO BACK?
00470   00610 002001        RSS
00471   00611 102066        HLT ERH       NO
00472   00612 006004        INB           MOVE TO NEXT LOCATION
00473   00613 001425        CPB GMTSA     GOT TO THIS PROGRAM
00474   00614 001426        LDB GMTEA     YES SKIP OVER THIS SECTION
00475   00615 001357        CPB B7700     DONE THIS 4K?
00476   00616 002001        RSS
00477   00617 000554        JMP L00       NO DO NEXT LOCATION
00478         000620  GMTE  EQU *
```

```
00480*                    PRE-TEST PART A (BP)
00481*
00482  00620 003400         CCA
00483  00621 001335         AND B0
00484  00622 002002         SZA
00485  00623 102066         HLT ERH        AND
00486  00624 001406         LDA ALT0
00487  00625 001410         AND ALT1
00488  00626 002002         SZA
00489  00627 102066         HLT ERH        AND
00490  00630 001410         LDA ALT1
00491  00631 001406         AND ALT0
00492  00632 002002         SZA
00493  00633 102066         HLT ERH        AND
00494  00634 003400         CCA
00495  00635 001406         AND ALT0
00496  00636 001406         CPA ALT0
00497  00637 002001         RSS
00498  00640 102066         HLT ERH        AND
00499  00641 003400         CCA
00500  00642 001410         AND ALT1
00501  00643 001410         CPA ALT1
00502  00644 002001         RSS
00503  00645 102066         HLT ERH        AND
00504*
00505  00646 002400         CLA
00506  00647 001335         XOR B0
00507  00650 002002         SZA
00508  00651 102066         HLT ERH        XOR
00509  00652 001406         XOR ALT0
00510  00653 001406         CPA ALT0
00511  00654 002001         RSS
00512  00655 102066         HLT ERH        XOR
00513  00656 001410         XOR ALT1
00514  00657 001363         CPA M1
00515  00660 002001         RSS
00516  00661 102066         HLT ERH        XOR
00517  00662 001406         XOR ALT0
00518  00663 001410         CPA ALT1
00519  00664 002001         RSS
00520  00665 102066         HLT ERH        XOR
00521  00666 001410         XOR ALT1
00522  00667 002002         SZA
00523  00670 102066         HLT ERH        XOR
00524  00671 003400         CCA
00525  00672 001363         XOR M1
00526  00673 002002         SZA
00527  00674 102066         HLT ERH        XOR
```

```
00529*                    PRE-TEST PART A (BP)
00530*
00531  00675 002400         CLA
00532  00676 001335         IOR B0
00533  00677 002002         SZA
00534  00700 102066         HLT ERH        IOR
00535  00701 001406         IOR ALT0
00536  00702 001406         CPA ALT0
00537  00703 002001         RSS
00538  00704 102066         HLT ERH        IOR
00539  00705 001410         IOR ALT1
00540  00706 001363         CPA M1
00541  00707 002001         RSS
00542  00710 102066         HLT ERH        IOR
00543  00711 002400         CLA
00544  00712 001410         IOR ALT1
00545  00713 001410         CPA ALT1
00546  00714 002001         RSS
00547  00715 102066         HLT ERH        IOR
00548  00716 001406         IOR ALT0
00549  00717 001363         CPA M1
00550  00720 002001         RSS
00551  00721 102066         HLT ERH        IOR
```

```
00553*                    PRE-TEST PART A (BP)
00554*
00555  00722 002400         CLA
00556  00723 006400         CLB
00557  00724 001371         STA TMPA
00558  00725 001362  L01    CPA B100K
00559  00726 002001         RSS
00560  00727 000734         JMP *+5
00561  00730 102201         SOC
00562  00731 002040         SEZ
00563  00732 102066         HLT ERH        E SET / O NOT SET
00564  00733 103101         CLO
00565  00734 102301         SOS
00566  00735 002040         SEZ
00567  00736 102066         HLT ERH        E / O  SET
00568  00737 002004         INA
00569  00740 002003         SZA,RSS
00570  00741 000756         JMP NXT01
00571  00742 006004         INB
00572  00743 006003         SZB,RSS
00573  00744 102066         HLT ERH        INA
00574  00745 001371         ISZ TMPA
00575  00746 002001         RSS
00576  00747 102066         HLT ERH        ISZ
00577  00750 001371         CPA TMPA
00578  00751 002001         RSS
00579  00752 102066         HLT ERH        ISZ / INA
00580  00753 000000         CPB A
00581  00754 000725         JMP L01
00582  00755 102066         HLT ERH        ISZ / INB
00583  00756 002040  NXT01   SEZ
00584  00757 102201         SOC
00585  00760 102066         HLT ERH        E NOT SET / O SET
00586  00761 000040         CLE
00587  00762 006004         INB
00588  00763 002040         SEZ
00589  00764 102201         SOC
00590  00765 102066         HLT ERH        E NOT SET / O  SET
00591  00766 000040         CLE
00592  00767 006002         SZB
00593  00770 102066         HLT ERH        INB
00594  00771 001371         ISZ TMPA
00595  00772 102066         HLT ERH        ISZ
00596  00773 102301         SOS
00597  00774 002040         SEZ
00598  00775 102066         HLT ERH        E / O SET
```

```
00600*                    PRE-TEST PART A (BP)
00601*
00602  00776 002400         CLA
00603  00777 007400         CCB
00604  01000 001336         ADA B1
00605  01001 102301         SOS
00606  01002 002040         SEZ
00607  01003 102066         HLT ERH        E / 0 SET
00608  01004 001336         ADB B1
00609  01005 002040         SEZ
00610  01006 102201         SOC
00611  01007 102066         HLT ERH        E NOT SET / 0 SET
00612  01010 000040         CLE
00613  01011 001336         CPA B1
00614  01012 006002         SZB
00615  01013 102066         HLT ERH        ADA/ADB
00616  01014 003400         CCA
00617  01015 006400         CLB
00618  01016 001336         ADB B1
00619  01017 102301         SOS
00620  01020 002040         SEZ
00621  01021 102066         HLT ERH        E / 0 SET
00622  01022 001336         ADA B1
00623  01023 002040         SEZ
00624  01024 102201         SOC
00625  01025 102066         HLT ERH        E NOT SET / 0 SET
00626  01026 000040         CLE
00627  01027 001336         CPB B1
00628  01030 002002         SZA
00629  01031 102066         HLT ERH        ADA/ADB
00630  01032 002400         CLA
00631  01033 007400         CCB
00632  01034 001363         ADA M1
00633  01035 102301         SOS
00634  01036 002040         SEZ
00635  01037 102066         HLT ERH        E / 0 SET
00636  01040 001363         ADB M1
00637  01041 002040         SEZ
00638  01042 102201         SOC
00639  01043 102066         HLT ERH        E NOT SET / 0 SET
00640  01044 000040         CLE
00641  01045 001363         CPA M1
00642  01046 002001         RSS
00643  01047 102066         HLT ERH        ADA
00644  01050 001364         CPB M2
00645  01051 002001         RSS
00646  01052 102066         HLT ERH        ADB
00647  01053 003400         CCA
00648  01054 006400         CLB
00649  01055 001363         ADB M1
00650  01056 102301         SOS
00651  01057 002040         SEZ
00652  01060 102066         HLT ERH        E / 0 SET
00653  01061 001363         ADA M1
```

```
00654  01062 002040        SEZ
00655  01063 102201        SOC
00656  01064 102066        HLT ERH       E NOT SET / 0 SET
00657  01065 000040        CLE
00658  01066 001364        CPA M2
00659  01067 002001        RSS
00660  01070 102066        HLT ERH       ADA
00661  01071 001363        CPB M1
00662  01072 002001        RSS
00663  01073 102066        HLT ERH       ADB
00664  01074 001406        LDA ALT0
00665  01075 001410        LDB ALT1
00666  01076 001410        ADB ALT1
00667  01077 102201        SOC
00668  01100 002040        SEZ
00669  01101 102066        HLT ERH       E SET / 0 NOT SET
00670  01102 103101        CLO
00671  01103 001411        ADA ALT1A
00672  01104 002040        SEZ
00673  01105 102201        SOC
00674  01106 102066        HLT ERH       E NOT SET / 0 SET
00675  01107 000040        CLE
00676  01110 001406        CPB ALT0
00677  01111 002002        SZA
00678  01112 102066        HLT ERH       ADA/ADB
00679  01113 001410        LDA ALT1
00680  01114 001406        LDB ALT0
00681  01115 001406        ADA ALT0
00682  01116 102301        SOS
00683  01117 002040        SEZ
00684  01120 102066        HLT ERH       E / 0  SET
00685  01121 001411        ADB ALT1A
00686  01122 002040        SEZ
00687  01123 102201        SOC
00688  01124 102066        HLT ERH       E NOT SET / 0 SET
00689  01125 000040        CLE
00690  01126 001363        CPA M1
00691  01127 006002        SZB
00692  01130 102066        HLT ERH       ADA/ADB
```

```
00694*                    PRE-TEST PART A (BP)
00695*
00696*     *   CALCULATE MEMORY SIZE & RUN MEMORY ADDRESS AND PATTERN ON
00697*         MEMORY ABOVE 4K-IF MEMORY>4K.
00698*
00699  01131 001360         LDB B10K      START WITH 8K
00700  01132 001337         ADB B3        MOVE TO ADDRESS 3
00701  01133 002400  L02    CLA           CLEAR WRAPAROUND
00702  01134 000003         STA 3B
00703  01135 001406         LDA ALT0      TRY TO
00704  01136 000001         STA B,I        WRITE PATTERN THERE
00705  01137 000003         CPA 3B        DID IT WRAPAROUND
00706  01140 001152         JMP NXT02     YES - NO MEMORY
00707  01141 000001         CPA B,I       DID THE PATTERN STORE?
00708  01142 001147         JMP *+5       YES.MEMORY IS THERE
00709  01143 002400         CLA           NO.SHOULD
00710  01144 000001         CPA B,I        BE ALL
00711  01145 001152         JMP NXT02       0'S
00712  01146 102066         HLT ERH       NOT 0.SOMETHING'S WRONG
00713  01147 001360         ADB B10K      MOVE UP 4K
00714  01150 006021         SSB,RSS       DONE 32K?
00715  01151 001133         JMP L02       NO
00716  01152 000001  NXT02 LDA B          CHANGE HANDS
00717  01153 001365         ADA M10K      BACK UP ONE STEP
00718  01154 000040         CLE
00719  01155 103101         CLO
00720  01156 001337         CPA B3        ONLY 4K?
00721  01157 001771         JMP NXT05     YES - SKIP MEMORY TESTS
00722  01160 001361         AND B70K      ELIMINATE LOWER 2 BITS
00723  01161 001357         ADA B7700     POINT TO BINARY LOADER
00724  01162 001363         ADA M1
00725  01163 102601         OTA SWREG     DISPLAY MEMORY SIZE
00726  01164 002040         SEZ
00727  01165 102201         SOC
00728  01166 102066         HLT ERH       E NOT SET / 0 SET
00729  01167 000040         CLE
00730  01170 001376         STA LADD       LWAM
00731  01171 001357         LDA B7700     SET FWAM
00732  01172 001375         STA FADD
```

```
00734*      *   QUICK MEMORY ADDRESS TEST
00735*
00736  01173 001375        LDA FADD
00737  01174 000000  L03    STA A,I        STORE IN EACH
00738  01175 001376        CPA LADD        LOCATION OF AVAILABLE
00739  01176 001201        JMP *+3          MEMORY THE ADDRESS
00740  01177 002004        INA               OF THAT LOCATION
00741  01200 001174        JMP L03
00742  01201 001375        LDA FADD
00743  01202 000000  L04    CPA A,I        VERIFY MEMORY
00744  01203 002001        RSS             CONTENTS
00745  01204 102066        HLT ERH        MEMORY ADDRESS FAILURE
00746  01205 001376        CPA LADD
00747  01206 001211        JMP *+3        GO ON TO MEMORY PATTERN TEST
00748  01207 002004        INA
00749  01210 001202        JMP L04
00750*
00751*      *   QUICK MEMORY PATTERN TEST
00752*
00753  01211 003400        CCA            START WITH 177777
00754  01212 001375  L05    LDB FADD
00755  01213 000001  L06    STA B,I        WRITE PATTERN
00756  01214 006004        INB             IN A REG IN
00757  01215 001376        CPB LADD         AVAILABLE MEMROY
00758  01216 002001        RSS
00759  01217 001213        JMP L06
00760  01220 001375        LDB FADD
00761  01221 000001  L07    CPA B,I        COMPARE PATTERN READ
00762  01222 002001        RSS             TO PATTERN WRITTEN
00763  01223 102066        HLT ERH        MEMORY PATTERN FAILED
00764  01224 006004        INB
00765  01225 001376        CPB LADD
00766  01226 002001        RSS
00767  01227 001221        JMP L07
00768  01230 001410        CPA ALT1       DONE 125252 YET?
00769  01231 001241        JMP NXT03      YES
00770  01232 001406        CPA ALT0
00771  01233 001410        LDA ALT1
00772  01234 002003        SZA,RSS
00773  01235 001406        LDA ALT0
00774  01236 001363        CPA M1
00775  01237 002400        CLA
00776  01240 001212        JMP L05
00777         001241  NXT03 EQU *
```

```
00779*                    PRE-TEST PART A (BP)
00780*
00781*     WORST CASE PATTERN TEST
00782*
00783  01241 001375         LDA FADD
00784  01242 001375         LDB FADD
00785  01243 001371  L08     STA TMPA
00786  01244 001353         AND B140      WRITE
00787  01245 001353         CPA B140         WORST
00788  01246 002400         CLA                CASE
00789  01247 002002         SZA                   PATTERN
00790  01250 003400         CCA
00791  01251 000001         STA B,I           IN MEMORY
00792  01252 001376         CPB LADD
00793  01253 001260         JMP NXT04
00794  01254 006004         INB
00795  01255 001371         LDA TMPA
00796  01256 002004         INA
00797  01257 001243         JMP L08
00798  01260 001375  NXT04   LDA FADD
00799  01261 001375         LDB FADD
00800  01262 001371  L09     STA TMPA
00801  01263 001353         AND B140      NOW
00802  01264 001353         CPA B140         COMPARE
00803  01265 002400         CLA                PATTERN
00804  01266 002002         SZA
00805  01267 003400         CCA
00806  01270 000001         CPA B,I
00807  01271 002001         RSS
00808  01272 102066         HLT ERH        MEMORY PATTERN FAILED
00809  01273 001376         CPB LADD
00810  01274 001771         JMP NXT05      CONTINUE
00811  01275 001437         LDA MHLT       FILL UNUSED MEMORY
00812  01276 000001         STA B,I          WITH HALTS
00813  01277 006004         INB
00814  01300 001371         LDA TMPA
00815  01301 002004         INA
00816  01302 001262         JMP L09
```

```
00818*                    PRE-TEST PART A (BP)
00819*
00820*                    PROGRAM COMES HERE FROM CURRENT PAGE
00821*
00822*
00823  01303 001305  BPJP0 JMP *+2,I
00824  01304 102066        HLT ERH       JMP (BP),I (TO BP)
00825  01305 001310        DEF *+3
00826  01306 102066        HLT ERH       JMP (BP),I (TO BP)
00827  01307 102066        HLT ERH         "          "
00828  01310 001312        JMP *+2,I
00829  01311 102066        HLT ERH       JMP (BP),I (TO CP)
00830  01312 002037        DEF CPJP0
00831  01313 102066        HLT ERH       JMP (BP),I (TO CP)
00832  01314 102066        HLT ERH            "       "
00833  01315 001317  BPJP1 JMP *+2,I
00834  01316 102066        HLT ERH       JMP (BP),I (TO CP)
00835  01317 002044        DEF CPJP1
00836  01320 102066        HLT ERH       JMP (BP),I (TO CP)
00837  01321 102066        HLT ERH            "       "
00838*
00839  01322 000000  BPJB0 NOP
00840  01323 001322        LDA *-1
00841  01324 001431        CPA DJBR2
00842  01325 002001        RSS
00843  01326 102066        HLT ERH       JSB (BP) FROM CP RETURN ADDRESS
00844  01327 000132        LDA HLT0
00845  01330 001332        JSB *+2,I
00846  01331 102066  JBR5  HLT ERH       JSB (BP),I TO CP
00847  01332 002105        DEF CPJB0
00848  01333 102066        HLT ERH       JSB (BP),I TO CP
00849  01334 102066        HLT ERH       JSB (BP),I TO CP
00850*
00851*                    END OF PRE-TEST PART A (BP)
```

```
00853*      *   STORAGE AND CONSTANTS
00854*
00855  01335 000000  B0     OCT 0
00856  01336 000001  B1     OCT 1
00857  01337 000003  B3     OCT 3
00858  01340 000004  B4     OCT 4
00859  01341 000005  B5     OCT 5
00860  01342 000006  B6     OCT 6
00861  01343 000007  B7     OCT 7
00862  01344 000017  B17    OCT 17
00863  01345 000037  B37    OCT 37
00864  01346 000040  B40    OCT 40
00865  01347 000054  B54    OCT 54
00866  01350 000060  B60    OCT 60
00867  01351 000070  B70    OCT 70
00868  01352 000077  B77    OCT 77
00869  01353 000140  B140   OCT 140
00870  01354 000170  B170   OCT 170
00871  01355 000177  B177   OCT 177
00872  01356 000777  B777   OCT 777
00873  01357 007700  B7700  OCT 7700
00874  01360 010000  B10K   OCT 10000
00875  01361 070000  B70K   OCT 70000
00876  01362 100000  B100K  OCT 100000
00877  01363 177777  M1     OCT -1
00878  01364 177776  M2     OCT -2
00879  01365 170000  M10K   OCT -10000
00880  01366 177760  M17    OCT 177760
00881  01367 177700  M77    OCT 177700
00882  01370 107777  M70K   OCT 107777
00883  01371 177777  TMPA   OCT -1
00884  01372 000000  TMPB   OCT 0
00885  01373 000000  SVA    NOP
00886  01374 000000  SVB    NOP
00887  01375 000000  FADD   NOP
00888  01376 000000  LADD   NOP
00889  01377 000000  DISN   NOP
00890  01400 000000  DIBP   NOP
00891  01401 000000  SWRX   NOP
00892  01402 000000  BIOSC  NOP
00893  01403 000000  SCX    NOP
00894  01404 000000  IBUFP  NOP
00895  01405 172525  APTRN  OCT 172525
00896  01406 125252  ALT0   OCT 125252
00897  01407 125253  ALT0A  OCT 125253
00898  01410 052525  ALT1   OCT 052525
00899  01411 052526  ALT1A  OCT 052526
```

```
00901  01412 002720  CFIG  DEF CFRG
00902  01413 004160  CHSC  DEF CKSC
00903  01414 004142  ISCR  DEF ISC
00904  01415 004057  MDVR  DEF MVDVR
00905  01416 004000  CFM   DEF CFMEM
00906  01417 004173  MSG   DEF MSGR
00907  01420 004230  IBUFD DEF IBUF
00908  01421 004243  CNST  DEF CNTS
00909  01422 004341  CNSC  DEF CVSC
00910  01423 001371  DTMPA DEF TMPA
00911  01424 001372  DTMPB DEF TMPB
00912  01425 000551  GMTSA DEF GMTS
00913  01426 000620  GMTEA DEF GMTE
00914  01427 000530  DJBR0 DEF JBR0
00915  01430 000540  DJBR1 DEF JBR1
00916  01431 002104  DJBR2 DEF JBR2
00917  01432 006740  DTMC  DEF TMC
00918  01433 006734  DTMI  DEF TMI
00919  01434 007431  DLDVR DEF LDVR
00920  01435 007327  DCO   DEF CNSLO
00921  01436 007404  LPDV  DEF LNPTR
00922  01437 106075  MHLT  OCT 106075
00923*
00924*
00925  01440 001441  CFMPJ JSB *+1
00926  01441 000000       NOP
00927  01442 103100       CLF INTP
00928  01443 107705       CLC 5B,C      TURN OFF MEMORY PROTECT
00929  01444 006400       CLB
00930  01445 001441       JMP *-4,I     RETURN
00931*
00932  01446 101447  DEFT  DEF *+1,I
00933  01447 000101       OCT 101,102,103,104,106,107
00934  01455 000121       OCT 121,122,123,124,125,127
00935  01463 001432       DEF DTMC
00936  01464 006501       DEF LDMXA
00937  01465 006562       DEF FMTBF
00938  01466 004132       DEF DOTBUS
00939  01467 004133       DEF DSTDMA
00940  01470 004134       DEF DCSLEN
00941  01471 004135       DEF DCSDMA
00942  01472 004136       DEF DLDMXA
00943  01473 004127       DEF DCSDMAA
00944  01474 004137       DEF CSSDMAA
00945  01475 004131       DEF DCSTATW
00946  01476 001363       DEF M1
00947*
00948  01477 160000  DMABT OCT 160000
```

```
00950  01500 001501  CPTOT DEF CPTT
00951*
00952  01501 177404  CPTT  DEC -252
00953  01502 000000        OCT 0
00954  01503 177313        DEC -309
00955  01504 010000        OCT 10000     16A
00956  01505 177313        DEC -309
00957  01506 020010        OCT 20010     16B
00958  01507 177313        DEC -309
00959  01510 030010        OCT 30010     16C
00960  01511 177412        DEC -246
00961  01512 040000        OCT 40000     15A
00962  01513 177412        DEC -246
00963  01514 050010        OCT 50010     14A
00964  01515 177412        DEC -246
00965  01516 060210        OCT 60210     14B
00966  01517 177404        DEC -252
00967  01520 070033        OCT 70033     2100
00968  01521 177465        DEC -203
00969  01522 100133        OCT 100133    21MX
00970  01523 174733  XETC  DEC -1573
00971  01524 110133        OCT 110133    21XE
00972  01525 177404        DEC -252
00973  01526 000000        OCT 0
00974  01527 177404        DEC -252
00975  01530 000000        OCT 0
00976  01531 177404        DEC -252
00977  01532 000000        OCT 0
00978  01533 177404        DEC -252
00979  01534 000000        OCT 0
00980  01535 177404        DEC -252
00981  01536 000000        OCT 0
00982  01537 177404        DEC -252
00983  01540 000000        OCT 0
```

```
00986  01541 101536  CFCTP DEF *-3,I
00987  01542 031061        ASC 4,2116,_
00988  01546 031061        ASC 4,2116,_
00989  01552 031061        ASC 4,2116,_
00990  01556 031061        ASC 4,2115,_
00991  01562 031061        ASC 4,2114,_
00992  01566 031061        ASC 4,2114,_
00993  01572 031061        ASC 4,2100,_
00994  01576 031061        ASC 4,21MX M,_
00995  01602 031061        ASC 4,21MX E,_
00996*
00997  01606 001607  CFDNA DEF *+1
00998  01607 020116        ASC 05, NO DMA, _
00999  01614 001615  CFDIV DEF *+1
01000  01615 020104        ASC 04, DMA, _
01001  01621 001622  CFMNA DEF *+1
01002  01622 047117        ASC 05,NO MPRT, _
01003  01627 001630  CFMIV DEF *+1
01004  01630 046520        ASC 04,MPRT, _
01005*
01006  01634 001635  CFMTB DEF *+1
01007  01635 001645        DEF CFMS0
01008  01636 001647        DEF CFMS1
01009  01637 001651        DEF CFMS2
01010  01640 001654        DEF CFMS3
01011  01641 001657        DEF CFMS4
01012  01642 001662        DEF CFMS5
01013  01643 001665        DEF CFMS6
01014  01644 001670        DEF CFMS7
01015*
01016  01645 032113  CFMS0 ASC 2,4K _
01017  01647 034113  CFMS1 ASC 2,8K _
01018  01651 030462  CFMS2 ASC 3,12K _
01019  01654 030466  CFMS3 ASC 3,16K _
01020  01657 031060  CFMS4 ASC 3,20K _
01021  01662 031064  CFMS5 ASC 3,24K _
01022  01665 031070  CFMS6 ASC 3,28K _
01023  01670 031462  CFMS7 ASC 3,32K _
01024  01673 001674  CFMS  DEF *+1
01025  01674 046505        ASC 04,MEMORY/
```

```
01028  01700 000000  CCSDY NOP
01029  01701 102071        HLT 71B       NO DEVICE
01030  01702 002400        CLA
01031  01703 000112        STA CODSC
01032  01704 000114        STA CIDSC
01033  01705 001700        JMP CCSDY,I
01034*
01035  01706 001707  CSLDY DEF *+1
01036*
01037  01707 000000  OCSDY NOP           PSEUDO CONSOLE DRIVER
01038  01710 002400        CLA
01039  01711 006400        CLB
01040  01712 127327        ABS JMP+CSLO+100000B
01041*
01042  01713 001714  CNSLD DEF *+1
01043  01714 004612  CD531 DEF 0531
01044  01715 000000        DEF *-*
01045  01716 004661  CD587 DEF 0587
01046  01717 000000        DEF *-*
01047  01720 004753  CD966 DEF 0966
01048  01721 004736        DEF C966
01049  01722 001707        DEF OCSDY
01050  01723 001700        DEF CCSDY
01051  01724 001707        DEF OCSDY
01052  01725 001700        DEF CCSDY
01053  01726 001707        DEF OCSDY
01054  01727 001700        DEF CCSDY
01055  01730 001707        DEF OCSDY
01056  01731 001700        DEF CCSDY
01057  01732 007327        DEF CNSLO     MAINTAIN CURRENT DRIVER FOR LINK
01058  01733 000000        DEF *-*
01059*
01060*
01061  01734 000000  ICSDY NOP           PSEUDO CONSOLE INPUT DRIVER
01062  01735 002400        CLA           (MUST BE 21 WORDS AFTER OCSDY)
01063  01736 006400        CLB
01064  01737 106071        OCT 106071
01065  01740 127354        ABS JMP+CSLI+100000B
```

```
01067  01741 001742  LPDF  DEF *+1
01068  01742 005024        DEF OLP67
01069  01743 005050        DEF OLPXX
01070                LPDYD REP 5
01071  01744 001752        DEF OLPDY
01072  01751 007404        DEF LNPTR
01073*
01074*
01075  01752 000000  OLPDY NOP
01076  01753 073166    ABS STA+BFR       SAVE A
01077  01754 063404    ABS LDA+LPTR      GET RETURN ADDRESS
01078  01755 073327    ABS STA+CSLO      PUT IT IN CONSOLE
01079  01756 063166    ABS LDA+BFR       RESTORE A
01080  01757 027330    ABS JMP+CSLO+1
01081*
01082*
01083  01760 004602  DINDD DEF DINDT
01084*
01085  01761 001762  LDDY  DEF LDDY0
01086*
01087  01762 000000  LDDY0 NOP           PSEUDO LOADER DRIVER
01088  01763 106072        OCT 106072
01089  01764 003400        CCA           SET EOT IF RUN IS PRESSED
01090  01765 127431        ABS JMP+LD+100000B
01091*
01092        000003  BPROOM EQU 1771B-*  (PAGE1 SHOULD START PAGE 1)
01093                      REP BPROOM         ADJUST SO PAGE1 IS FIRST ON PAGE1
01094  01766 106075        OCT 106075    MEMORY HALT
```

```
01096*                    START OF PRE-TEST PART B (CP)
01097*
01098  01771 002400  NXT05 CLA
01099  01772 102601        OTA SWREG      CLEAR S-REG.
01100  01773 102301        SOS
01101  01774 002040        SEZ
01102  01775 102066        HLT ERH        E / O SET
01103  01776 000132        LDA HLT0       HALT IF CURRENT PAGE/
01104  01777 000132        LDB HLT0          BASE PAGE DOESN'T WORK
01105  02000 002001  PAGE1 JMP *+1
01106  02001 002764        LDB .ALT1
01107  02002 001406        LDA ALT0
01108  02003 002001        RSS
01109  02004 000001        OCT 1          USED IN CPU TYPE CALCULATION
01110  02005 002771        STA .TMPA
01111  02006 001372        STB TMPB
01112  02007 002763        CPA .ALT0
01113  02010 002001        RSS
01114  02011 102066        HLT ERH        LDA (BP) / CPA (CP)
01115  02012 001410        CPB ALT1
01116  02013 002001        RSS
01117  02014 102066        HLT ERH        LDB (CP) / CPB (BP)
01118  02015 002771        LDB .TMPA
01119  02016 001372        LDA TMPB
01120  02017 002764        CPA .ALT1
01121  02020 002001        RSS
01122  02021 102066        HLT ERH        STB (BP)   CPA (CP)
01123  02022 001406        CPB ALT0
01124  02023 002001        RSS
01125  02024 102066        HLT ERH        STA (CP) / CPB (BP)
```

```
01127*                    PRE-TEST PART B (CP)
01128  02025 002027         JMP *+2
01129  02026 102066         HLT ERH        JMP (CP)
01130  02027 002033         JMP *+4
01131  02030 102066         HLT ERH        JMP (CP)
01132  02031 002035         JMP *+4
01133  02032 102066         HLT ERH        JMP (CP)
01134  02033 002031         JMP *-2
01135  02034 102066         HLT ERH        JMP (CP)
01136*
01137  02035 001303         JMP BPJP0
01138  02036 102066         HLT ERH        JMP (CP) TO (BP)
01139  02037 002041  CPJP0 JMP *+2,I
01140  02040 102066         HLT ERH        JMP (CP),I (TO BP)
01141  02041 001315         DEF BPJP1
01142  02042 102066         HLT ERH        JMP (CP),I (TO BP)
01143  02043 102066         HLT ERH          "   "       "
01144  02044 002046  CPJP1 JMP *+2,I
01145  02045 102066         HLT ERH        JMP (CP),I (TO CP)
01146  02046 002051         DEF *+3
01147  02047 102066         HLT ERH        JMP (CP),I (TO CP)
01148  02050 102066         HLT ERH            "         "
01149*
01150  02051 002400         CLA
01151  02052 002062         STA .JB0
01152  02053 002075         STA .JB1
01153  02054 001322         STA BPJB0
01154  02055 002105         STA CPJB0
01155  02056 000132         LDA HLT0
01156  02057 000132         LDB HLT0
01157  02060 002062         JSB *+2
01158  02061 102066  JBR3   HLT ERH        JSB (CP)
01159  02062 000000  .JB0    NOP
01160  02063 002062         LDA *-1
01161  02064 002773         CPA DJBR3
01162  02065 002001         RSS
01163  02066 102066         HLT ERH        JSB (CP) RETURN ADRESS
01164  02067 000132         LDA HLT0
01165  02070 002072         JSB *+2,I
01166  02071 102066  JBR4   HLT ERH        JSB (CP),I
01167  02072 002075         DEF *+3
01168  02073 102066         HLT ERH        JSB (CP),I
01169  02074 102066         HLT ERH        JSB (CP),I
01170  02075 000000  .JB1    NOP
01171  02076 002075         LDA *-1
01172  02077 002774         CPA DJBR4
01173  02100 002001         RSS
01174  02101 102066         HLT ERH        JSB (CP),I  RETURN ADDRESS
01175  02102 000132         LDA HLT0
01176  02103 001322         JSB BPJB0
01177  02104 102066  JBR2   HLT ERH        JSB (BP)
01178  02105 000000  CPJB0  NOP
01179  02106 002105         LDA *-1
01180  02107 002775         CPA DJBR5
```

```
01181  02110 002001        RSS
01182  02111 102066        HLT ERH       JSB (BP),I TO CP RETURN ADDRESS
```

```
01184*                    PRE-TEST PART B (CP)
01185*
01186  02112 002765         LDA SRGP1     1000100100100111
01187  02113 002766         LDB SRGP2                      1001100000100000
01188  02114 001000         ALS           1001001001001110
01189  02115 005100         BRS                            1100110000010000
01190  02116 001100         ARS           1100100100100111
01191  02117 005400         BLR                            0001100000100000
01192  02120 001000         ALS           1001001001001110
01193  02121 005700         BLF                            1000001000000001
01194  02122 001300         RAR           0100100100100111
01195  02123 005000         BLS                            1000010000000010
01196  02124 001100         ARS           0010010010010011
01197  02125 005300         RBR                            0100001000000001
01198  02126 001400         ALR           0100100100100110
01199  02127 005000         BLS                            0000010000000010
01200  02130 001200         RAL           1001001001001100
01201  02131 005700         BLF                            0100000000100000
01202  02132 001100         ARS           1100100100100110
01203  02133 005200         RBL                            1000000001000000
01204  02134 001400         ALR           0001001001001100
01205  02135 005100         BRS                            1100000000100000
01206  02136 001700         ALF           0010010011000001
01207  02137 005200         RBL                            1000000001000001
01208  02140 001200         RAL           0100100110000010
01209  02141 005100         BRS                            1100000000100000
01210  02142 001000         ALS           0001001100000100
01211  02143 005300         RBR                            0110000000010000
01212  02144 001300         RAR           0000100110000010
01213  02145 005400         BLR                            0100000000100000
01214  02146 001700         ALF           1001100000100000
01215  02147 005000         BLS                            0000000001000000
01216  02150 002766         CPA SRGP2
01217  02151 002001         RSS
01218  02152 102066         HLT ERH       SRG INST A-REG.
01219  02153 002767         CPB SRGP3
01220  02154 002001         RSS
01221  02155 102066         HLT ERH       SRG INST B-REG.
01222  02156 102301         SOS
01223  02157 002040         SEZ
01224  02160 102066         HLT ERH       E / O SET
```

```
01226*                    PRE-TEST PART B (CP)
01227*
01228  02161 002765         LDB SRGP1     1000100100100111
01229  02162 002766         LDA SRGP2                      1001100000100000
01230  02163 005000         BLS           1001001001001110
01231  02164 001100         ARS                            1100110000010000
01232  02165 005100         BRS           1100100100100111
01233  02166 001400         ALR                            0001100000100000
01234  02167 005000         BLS           1001001001001110
01235  02170 001700         ALF                            1000001000000001
01236  02171 005300         RBR           0100100100100111
01237  02172 001000         ALS                            1000010000000010
01238  02173 005100         BRS           0010010010010011
01239  02174 001300         RAR                            0100001000000001
01240  02175 005400         BLR           0100100100100110
01241  02176 001000         ALS                            0000010000000010
01242  02177 005200         RBL           1001001001001100
01243  02200 001700         ALF                            0100000000100000
01244  02201 005100         BRS           1100100100100110
01245  02202 001200         RAL                            1000000001000000
01246  02203 005400         BLR           0001001001001100
01247  02204 001100         ARS                            1100000000100000
01248  02205 005700         BLF           0010010011000001
01249  02206 001200         RAL                            1000000001000001
01250  02207 005200         RBL           0100100110000010
01251  02210 001100         ARS                            1100000000100000
01252  02211 005000         BLS           0001001100000100
01253  02212 001300         RAR                            0110000000010000
01254  02213 005300         RBR           0000100110000010
01255  02214 001400         ALR                            0100000000100000
01256  02215 005700         BLF           1001100000100000
01257  02216 001000         ALS                            0000000001000000
01258  02217 002766         CPB SRGP2
01259  02220 002001         RSS
01260  02221 102066         HLT ERH       SRG INST B-REG.
01261  02222 002767         CPA SRGP3
01262  02223 002001         RSS
01263  02224 102066         HLT ERH       SRG INST A-REG.
01264  02225 102301         SOS
01265  02226 002040         SEZ
01266  02227 102066         HLT ERH       E / O SET
```

```
01268*                    PRE-TEST PART B (CP)
01269*
01270  02230 002765         LDA SRGP1     1000100100100111
01271  02231 002766         LDB SRGP2                      1001100000100000
01272  02232 000020         OCT 0020 ALS  1001001001001110
01273  02233 004021         OCT 4021 BRS                   1100110000010000
01274  02234 000021         OCT 0021 ARS  1100100100100111
01275  02235 004024         OCT 4024 BLR                   0001100000100000
01276  02236 000020         OCT 0020 ALS  1001001001001110
01277  02237 004027         OCT 4027 BLF                   1000001000000001
01278  02240 000023         OCT 0023 RAR  0100100100100111
01279  02241 004020         OCT 4020 BLS                   1000010000000010
01280  02242 000021         OCT 0021 ARS  0010010010010011
01281  02243 004023         OCT 4023 RBR                   0100001000000001
01282  02244 000024         OCT 0024 ALR  0100100100100110
01283  02245 004020         OCT 4020 BLS                   0000010000000010
01284  02246 000022         OCT 0022 RAL  1001001001001100
01285  02247 004027         OCT 4027 BLF                   0100000000100000
01286  02250 000021         OCT 0021 ARS  1100100100100110
01287  02251 004022         OCT 4022 RBL                   1000000001000000
01288  02252 000024         OCT 0024 ALR  0001001001001100
01289  02253 004021         OCT 4021 BRS                   1100000000100000
01290  02254 000027         OCT 0027 ALF  0010010011000001
01291  02255 004022         OCT 4022 RBL                   1000000001000001
01292  02256 000022         OCT 0022 RAL  0100100110000010
01293  02257 004021         OCT 4021 BRS                   1100000000100000
01294  02260 000020         OCT 0020 ALS  0001001100000100
01295  02261 004023         OCT 4023 RBR                   0110000000010000
01296  02262 000023         OCT 0023 RAR  0000100110000010
01297  02263 004024         OCT 4024 BLR                   0100000000100000
01298  02264 000027         OCT 0027 ALF  1001100000100000
01299  02265 004020         OCT 4020 BLS                   0000000001000000
01300  02266 002766         CPA SRGP2
01301  02267 002001         RSS
01302  02270 102066         HLT ERH       SRG INST A-REG.
01303  02271 002767         CPB SRGP3
01304  02272 002001         RSS
01305  02273 102066         HLT ERH       SRG INST B-REG.
01306  02274 102301         SOS
01307  02275 002040         SEZ
01308  02276 102066         HLT ERH       E / O SET
```

```
01310*                    PRE-TEST PART B (CP)
01311*
01312  02277 002765         LDB SRGP1     1000100100100111
01313  02300 002766         LDA SRGP2                          1001100000100000
01314  02301 004020         OCT 4020 BLS  1001001001001110
01315  02302 000021         OCT 0021 ARS                       1100110000010000
01316  02303 004021         OCT 4021 BRS  1100100100100111
01317  02304 000024         OCT 0024 ALR                       0001100000100000
01318  02305 004020         OCT 4020 BLS  1001001001001110
01319  02306 000027         OCT 0027 ALF                       1000001000000001
01320  02307 004023         OCT 4023 RBR  0100100100100111
01321  02310 000020         OCT 0020 ALS                       1000010000000010
01322  02311 004021         OCT 4021 BRS  0010010010010011
01323  02312 000023         OCT 0023 RAR                       0100001000000001
01324  02313 004024         OCT 4024 BLR  0100100100100110
01325  02314 000020         OCT 0020 ALS                       0000010000000010
01326  02315 004022         OCT 4022 RBL  1001001001001100
01327  02316 000027         OCT 0027 ALF                       0100000000100000
01328  02317 004021         OCT 4021 BRS  1100100100100110
01329  02320 000022         OCT 0022 RAL                       1000000001000000
01330  02321 004024         OCT 4024 BLR  0001001001001100
01331  02322 000021         OCT 0021 ARS                       1100000000100000
01332  02323 004027         OCT 4027 BLF  0010010011000001
01333  02324 000022         OCT 0022 RAL                       1000000001000001
01334  02325 004022         OCT 4022 RBL  0100100110000010
01335  02326 000021         OCT 0021 ARS                       1100000000100000
01336  02327 004020         OCT 4020 BLS  0001001100000100
01337  02330 000023         OCT 0023 RAR                       0110000000010000
01338  02331 004023         OCT 4023 RBR  0000100110000010
01339  02332 000024         OCT 0024 ALR                       0100000000100000
01340  02333 004027         OCT 4027 BLF  1001100000100000
01341  02334 000020         OCT 0020 ALS                       0000000001000000
01342  02335 002766         CPB SRGP2
01343  02336 002001         RSS
01344  02337 102066         HLT ERH       SRG INST B-REG.
01345  02340 002767         CPA SRGP3
01346  02341 002001         RSS
01347  02342 102066         HLT ERH       SRG INST A-REG.
01348  02343 102301         SOS
01349  02344 002040         SEZ
01350  02345 102066         HLT ERH       E / O SET
```

```
01352*                    PRE-TEST PART B (CP)
01353*
01354  02346 002770         LDA SRGEP     0111010001110010
01355  02347 002770         LDB SRGEP                      0111010001110010
01356  02350 001500         ERA           0011101000111001 0
01357  02351 005600         ELB                            0 1110100011100100
01358  02352 001500         ERA           0001110100011100 1
01359  02353 005600         ELB                            1 1101000111001001
01360  02354 001500         ERA           1000111010001110 0
01361  02355 005600         ELB                            1 1010001110010010
01362  02356 001500         ERA           1100011101000111 0
01363  02357 005600         ELB                            1 0100011100100100
01364  02360 001500         ERA           1110001110100011 1
01365  02361 005600         ELB                            0 1000111001001001
01366  02362 001500         ERA           0111000111010001 1
01367  02363 005600         ELB                            1 0001110010010011
01368  02364 001500         ERA           1011100011101000 1
01369  02365 005600         ELB                            0 0011100100100111
01370  02366 001500         ERA           0101110001110100 0
01371  02367 005600         ELB                            0 0111001001001110
01372  02370 005500         ERB                            0 0011100100100111
01373  02371 001600         ELA           1011100011101000 0
01374  02372 005500         ERB                            1 0001110010010011
01375  02373 001600         ELA           0111000111010001 1
01376  02374 005500         ERB                            1 1000111001001001
01377  02375 001600         ELA           1110001110100011 0
01378  02376 005500         ERB                            1 0100011100100100
01379  02377 001600         ELA           1100011101000111 1
01380  02400 005500         ERB                            0 1010001110010010
01381  02401 001600         ELA           1000111010001110 1
01382  02402 005500         ERB                            0 1101000111001001
01383  02403 001600         ELA           0001110100011100 1
01384  02404 005500         ERB                            1 1110100011100100
01385  02405 001600         ELA           0011101000111001 0
01386  02406 005500         ERB                            0 0111010001110010
01387  02407 001600         ELA           0111010001110010 0
01388  02410 002770         CPA SRGEP
01389  02411 002001         RSS
01390  02412 102066         HLT ERH       SRG E-REG ERROR
01391  02413 002770         CPB SRGEP
01392  02414 002001         RSS
01393  02415 102066         HLT ERH       SRG E-REG ERROR
01394  02416 102301         SOS
01395  02417 002040         SEZ
01396  02420 102066         HLT ERH       E / O SET
```

```
01398*                    PRE-TEST PART B (CP)
01399*
01400  02421 002770         LDA SRGEP     0111010001110010
01401  02422 002770         LDB SRGEP                      0111010001110010
01402  02423 000025         OCT 0025 ERA  0011101000111001 0
01403  02424 004026         OCT 4026 ELB                   0 1110100011100100
01404  02425 000025         OCT 0025 ERA  0001110100011100 1
01405  02426 004026         OCT 4026 ELB                   1 1101000111001001
01406  02427 000025         OCT 0025 ERA  1000111010001110 0
01407  02430 004026         OCT 4026 ELB                   1 1010001110010010
01408  02431 000025         OCT 0025 ERA  1100011101000111 0
01409  02432 004026         OCT 4026 ELB                   1 0100011100100100
01410  02433 000025         OCT 0025 ERA  1110001110100011 1
01411  02434 004026         OCT 4026 ELB                   0 1000111001001001
01412  02435 000025         OCT 0025 ERA  0111000111010001 1
01413  02436 004026         OCT 4026 ELB                   1 0001110010010011
01414  02437 000025         OCT 0025 ERA  1011100011101000 1
01415  02440 004026         OCT 4026 ELB                   0 0011100100100111
01416  02441 000025         OCT 0025 ERA  0101110001110100 0
01417  02442 004026         OCT 4026 ELB                   0 0111001001001110
01418  02443 004025         OCT 4025 ERB                   0 0011100100100111
01419  02444 000026         OCT 0026 ELA  1011100011101000 0
01420  02445 004025         OCT 4025 ERB                   1 0001110010010011
01421  02446 000026         OCT 0026 ELA  0111000111010001 1
01422  02447 004025         OCT 4025 ERB                   1 1000111001001001
01423  02450 000026         OCT 0026 ELA  1110001110100011 0
01424  02451 004025         OCT 4025 ERB                   1 0100011100100100
01425  02452 000026         OCT 0026 ELA  1100011101000111 1
01426  02453 004025         OCT 4025 ERB                   0 1010001110010010
01427  02454 000026         OCT 0026 ELA  1000111010001110 1
01428  02455 004025         OCT 4025 ERB                   0 1101000111001001
01429  02456 000026         OCT 0026 ELA  0001110100011100 1
01430  02457 004025         OCT 4025 ERB                   1 1110100011100100
01431  02460 000026         OCT 0026 ELA  0011101000111001 0
01432  02461 004025         OCT 4025 ERB                   0 0111010001110010
01433  02462 000026         OCT 0026 ELA  0111010001110010 0
01434  02463 002770         CPA SRGEP
01435  02464 002001         RSS
01436  02465 102066         HLT ERH       SRG E-REG ERROR
01437  02466 002770         CPB SRGEP
01438  02467 002001         RSS
01439  02470 102066         HLT ERH       SRG E-REG ERROR
01440  02471 102301         SOS
01441  02472 002040         SEZ
01442  02473 102066         HLT ERH       E / O SET
```

```
01444*                  PRE-TEST PART B (CP)
01445*
01446*                  BASIC I/O TEST
01447*
01448        002474  BIOT  EQU *
01449  02474 001401        LDA SWRX
01450  02475 001352        AND B77
01451  02476 001402        STA BIOSC     SAVE IT
01452  02477 002003        SZA,RSS       IS THERE ONE?
01453  02500 002702        JMP BIOEX     NO SKIP BASIC I/O
01454  02501 001351        AND B70       CHECK OVER 7B
01455  02502 002003        SZA,RSS
01456  02503 102066        HLT ERH
01457  02504 003001  BIO0  LDB BIOSD     UPDATE I/O INSTRUCTIONS
01458  02505 000001        LDA B,I
01459  02506 001363        CPA M1        END OF LIST
01460  02507 002515        JMP BIO1      YES - START EXECUTION
01461  02510 001367        AND M77       MASK OLD SC OFF
01462  02511 001402        IOR BIOSC      ADD NEW SC
01463  02512 000001        STA B,I       PUT IT BACK IN PLACE
01464  02513 006004        INB           MOVE TO NEXT INSTRUCTION
01465  02514 002505        JMP BIO0+1
01466  02515 001337  BIO1  LDB B3        SET TRAP CELLS
01467  02516 003000        LDA IHLT      TO INTERRUPT HALT
01468  02517 000001        STA B,I
01469  02520 001352        CPB B77       END
01470  02521 002524        JMP *+3       YES
01471  02522 006004        INB
01472  02523 002517        JMP *-4
01473  02524 107700        CLC INTP,C    GENERATE CRS TO ALL I/O
```

```
01475*                  PRE-TEST PART B (CP)
01476*
01477*                  BASIC I/O TEST
01478*
01479  02525 102100        STF INTP      TOGGLE INTERRUPT
01480  02526 103100        CLF INTP        FLAG TO CLEAR
01481  02527 102200        SFC INTP      IS IT CLEARED?
01482  02530 102066        HLT ERH       NO - ERROR
01483  02531 102300        SFS INTP      IS IT NOT SET
01484  02532 002001        RSS
01485  02533 102066        HLT ERH       NO - ERROR
01486  02534 102100        STF INTP      SET INTERRUPT FLAG
01487  02535 102300        SFS INTP      IS IT SET?
01488  02536 102066        HLT ERH       NO - ERROR
01489  02537 102200        SFC INTP      IS IT NOT CLEARED?
01490  02540 002001        RSS
01491  02541 102066        HLT ERH       NO - ERROR
01492  02542 103100        CLF INTP      TURN FLAG OFF
01493  02543 102100  BS01  STF SC        TOGGLE INTERFACE
01494  02544 103100  BS02  CLF SC          CARD FLAG TO CLEAR
01495  02545 102200  BS03  SFC SC        IS IT CLEARED?
01496  02546 102066        HLT ERH       NO - ERROR
01497  02547 102300  BS04  SFS SC        IS IT NOT SET?
01498  02550 002001        RSS
01499  02551 102066        HLT ERH       NO - ERROR
01500  02552 102100  BS05  STF SC        SET CARD FLAG
01501  02553 102300  BS06  SFS SC        IS IT SET
01502  02554 102066        HLT ERH       NO - ERROR
01503  02555 102200  BS07  SFC SC        IS IT NOT CLEAR?
01504  02556 002001        RSS
01505  02557 102066        HLT ERH       NO - ERROR
01506  02560 002751        JSB BIOI      SET INTERRUPT RETURN
01507  02561 002571        DEF BIOR1     INTERRUPT TO ERROR
01508  02562 102100  BS08  STF SC        SET THE FLAG
01509  02563 102700  BS09  STC SC          AND CONTROL
01510  02564 102100        STF INTP      TURN I/O SYSTEM ON THEN
01511  02565 103100        CLF INTP      TURN I/O SYSTEM OFF
01512  02566 000000        NOP           GIVE IT A CHANCE TO INTERRUPT
01513  02567 000000        NOP
01514  02570 002573        JMP *+3
01515  02571 000000  BIOR1 NOP
01516  02572 102066        HLT ERH       INTERRUPT CANT BE TURNED OFF
01517  02573 107700        CLC INTP,C    GENERATE CRS
```

```
01519*                    PRE-TEST PART B (CP)
01520*
01521*                    BSIC I/O TEST
01522*
01523  02574 107700  BS10  CLC SC,C      RESET SC FLAG AND CONTROL
01524  02575 003031        LDB B10       START WITH LOWEST ADDRESS
01525  02576 001402  BIO2  CPB BIOSC      IS IT THIS SELECT CODE
01526  02577 002607        JMP BIO3      YES - SKIP CHECK
01527  02600 002776        LDA .STF      SET UP
01528  02601 000001        IOR B           INSTRUCTIONS
01529  02602 002604        STA *+2
01530  02603 103100  BS11  CLF SC        CLEAR SC FLAG
01531  02604 000000        NOP
01532  02605 102200  BS12  SFC SC        CHECK SC FLAG
01533  02606 102066        HLT ERH       NOT CLEAR THEN ERROR
01534  02607 001352  BIO3  CPB B77       IS THAT THE LAST?
01535  02610 002613        JMP *+3       YES - MOVE TO NEXT TEST
01536  02611 006004        INB           NO - MOVE TO NEXT SC
01537  02612 002576        JMP BIO2        AND CHECK IT
01538  02613 107700        CLC INTP,C    CREATE CRS INCASE OF PRIV. INT.
01539  02614 002751        JSB BIOI      SET INTERRUPT LINK
01540  02615 002726        DEF BIOI0
01541  02616 002400        CLA           CLEAR FLAGS
01542  02617 002635        STA BIOJD
01543  02620 002726        STA BIOI0
01544  02621 001371        STA TMPA
01545  02622 102700  BS13  STC SC        TURN ON
01546  02623 102100  BS14  STF SC          CARD
01547  02624 102100        STF INTP       AND INTP'S
01548  02625 102701        STC 1         *
01549  02626 102101        STF 1         *
01550  02627 106701        CLC 1         *
01551  02630 103101        CLF 1         *  NO INTERRUPT
01552  02631 002632        JMP *+1,I     *  SHOULD OCCUR
01553  02632 002633        DEF *+1       *  HERE
01554  02633 002634        JSB *+1,I     *
01555  02634 002635        DEF *+1       *
01556  02635 000000  BIOJD NOP           *
01557  02636 001371        ISZ TMPA       INT. SHOULD BE HERE
01558  02637 001371        ISZ TMPA
01559  02640 103100        CLF INTP      TURN I/O SYSTEM OFF
01560  02641 107700  BS15  CLC SC,C      RESET SC FLAG AND CONTROL
01561  02642 002726        LDB BIOI0     DID IT INTERRUPT?
01562  02643 006003        SZB,RSS
01563  02644 102066        HLT ERH       NO - ERROR
01564  02645 001371        LDB TMPA       RETURN CORRECTLY
01565  02646 003030        CPB B2
01566  02647 002001        RSS
01567  02650 102066        HLT ERH       NO - ERROR
```

```
01569*                    PRE-TEST PART B (CP)
01570*
01571*                    BASIC I/O TEST
01572*
01573  02651 002751         JSB BIOI
01574  02652 002663         DEF BIOR2
01575  02653 102700  BS16   STC SC          CONTROL ON
01576  02654 102100  BS17   STF SC          FLAG UP
01577  02655 102100         STF INTP        TURN ON INTERRUPTS
01578  02656 106700  BS20   CLC SC          CLEAR SC CONTROL
01579  02657 000000         NOP             GIVE IT A CHANCE
01580  02660 000000         NOP             *
01581  02661 000000         NOP             *
01582  02662 002665         JMP *+3
01583  02663 000000  BIOR2  NOP
01584  02664 102066         HLT ERH         CONTROL NOT CLEARED
01585  02665 103100         CLF INTP        TURN INTP'S OFF
01586  02666 002751         JSB BIOI
01587  02667 002677         DEF BIOR3
01588  02670 102700  BS21   STC SC          TURN CONTROL ON
01589  02671 102100         STF INTP        TURN INTP'S ON
01590  02672 106700         CLC INTP        CLEAR I/O SYSTEM
01591  02673 000000         NOP             GIVE IT A CHANCE
01592  02674 000000         NOP             *
01593  02675 000000         NOP             *
01594  02676 002701         JMP *+3
01595  02677 000000  BIOR3  NOP
01596  02700 102066         HLT ERH
01597  02701 107700  BS22   CLC SC,C        TURN OFF DEVICE
01598  02702 107700  BIOEX  CLC INTP,C      TURN OFF ALL I O
01599  02703 001401         LDA SWRX        CHECK IF AUTOMATIC MODE
01600  02704 001357         AND B7700
01601  02705 002002         SZA
01602  02706 003034         JMP CFGR        YES GO TO CONFIGURATION
01603  02707 001401         LDA SWRX        CHECK IF LOOP
01604  02710 001360         AND B10K
01605  02711 002002         SZA
01606  02712 000140         JMP PTLP        YES LOOP
01607  02713 001401         LDA SWRX        RESTORE S-REG.
01608  02714 102601         OTA SWREG
01609  02715 001377         LDA DISN          AND A & B REG
01610  02716 001400         LDB DIBP
01611  02717 102077         HLT 77B         WAIT FOR CONFIGURATION INFORMATION
01612*
01613  02720 107700  CFRG   CLC INTP,C      TURN OFF ALL I/O
01614  02721 001377         STA DISN
01615  02722 001400         STB DIBP
01616  02723 102501         LIA SWREG       GET SWITCH REGISTER
01617  02724 001401         STA SWRX
01618  02725 003034         JMP CFGR        GO TO CONFIGURATION
```

```
01620*                    PRE-TEST PART B (CP)
01621*
01622*                    BASIC I/O TEST
01623*
01624  02726 000000  BIOI0 NOP
01625  02727 103100        CLF INTP      TURN I/O SYSTEM OFF
01626  02730 002635        LDB BIOJD     CHECK TO SE IF ALL
01627  02731 002747        CPB BIOD0        INSTRUCTIONS COMPLETED
01628  02732 002001        RSS
01629  02733 102066        HLT ERH       NO - ERROR
01630  02734 002750        LDB BIOD1     CHECK RETURN ADDRESS
01631  02735 002726        CPB BIOI0     *
01632  02736 002741        JMP *+3       *
01633  02737 006004        INB           *
01634  02740 002726        CPB BIOI0     *
01635  02741 002001        RSS           *
01636  02742 102066        HLT ERH       *
01637  02743 002751        JSB BIOI      SET ERROR IF SECOND INTP
01638  02744 002760        DEF BIOE
01639  02745 102100        STF INTP      TURN I/O SYSTEM ON
01640  02746 002726        JMP BIOI0,I   CONTINUE TEST
01641*
01642  02747 002634  BIOD0 DEF BIOJD-1
01643  02750 002636  BIOD1 DEF BIOJD+1
01644*
01645*
01646  02751 000000  BIOI  NOP
01647  02752 002751        LDB BIOI,I
01648  02753 002751        ISZ BIOI
01649  02754 000003        STB 3B
01650  02755 002777        LDB JSBI.
01651  02756 000000  BSSTB STB SC
01652  02757 002751        JMP BIOI,I
01653*
01654*
01655  02760 000000  BIOE  NOP
01656  02761 102066        HLT ERH       SECOND INTERRUPT OCCURED
01657  02762 002760        JMP BIOE,I
01658*
```

```
01660  02763 125252  .ALT0 OCT 125252
01661  02764 052525  .ALT1 OCT 052525
01662  02765 104447  SRGP1 OCT 104447    1000100100100111
01663  02766 114040  SRGP2 OCT 114040                      1001100000100000
01664  02767 000100  SRGP3 OCT 000100
01665  02770 072162  SRGEP OCT 072162    011010001110010
01666  02771 000000  .TMPA NOP
01667  02772 000000  .TMPB NOP
01668  02773 002061  DJBR3 DEF JBR3
01669  02774 002071  DJBR4 DEF JBR4
01670  02775 001331  DJBR5 DEF JBR5
01671  02776 102100  .STF  STF 0
01672  02777 000003  JSBI. JSB 3B,I
01673  03000 106077  IHLT  OCT 106077
01674*
01675*
01676  03001 103002  BIOSD DEF *+1,I
01677  03002 002543        DEF BS01
01678  03003 002544        DEF BS02
01679  03004 002545        DEF BS03
01680  03005 002547        DEF BS04
01681  03006 002552        DEF BS05
01682  03007 002553        DEF BS06
01683  03010 002555        DEF BS07
01684  03011 002562        DEF BS08
01685  03012 002563        DEF BS09
01686  03013 002574        DEF BS10
01687  03014 002603        DEF BS11
01688  03015 002605        DEF BS12
01689  03016 002622        DEF BS13
01690  03017 002623        DEF BS14
01691  03020 002641        DEF BS15
01692  03021 002653        DEF BS16
01693  03022 002654        DEF BS17
01694  03023 002656        DEF BS20
01695  03024 002670        DEF BS21
01696  03025 002701        DEF BS22
01697  03026 002756        DEF BSSTB
01698  03027 001363        DEF M1
01699*
01700*
01701  03030 000002  B2    OCT 2
01702  03031 000010  B10   OCT 10
01703  03032 010003  D8K3  OCT 10003
01704  03033 070003  D32K3 OCT 70003
```

Appendix E
Basic Binary Loader Listings

General

With the availability of the Configurator and diagnostics on different media and the 2100A/S, 2114A/B, 2115A, and 2116A/B/C computers not having appropriate absolute binary ROM loaders, it will be necessary to toggle the corresponding loader into the last 64 locations of any one page in the available base memory, excluding pages 0, 1, or 2. (The configurator will load into any memory location from 2 to 7677.)

Table E-1 summarizes the four loaders listed in Tables E-2 through E-5. Table E-1 also specifies the peripheral product and corresponding interface, subsystem, and loader format.

Table E-1. Basic Binary Loader Reference

LOADER LISTING	ASSOCIATED DEVICE			FORMAT
	PERIPHERAL PRODUCT	INTERFACE	SUBSYSTEM NUMBER	
Table E-2	7900 Cartridge Disc	13210 Disc Interface	12960A	Disc Boot
	7901 Cartridge Disc	13210A Disc Interface	12961A	Disc Boot
Table E-3	7905/20 Cartridge Disc	13175A or 13178B Disc Interface	12962A/B/C/D (for 7905 only)	Disc Boot
Table E-4	2644/45 CRT Terminal	12966A Buffered Async Interface or 12968A Async Interface	N/A	Absolute Binary
Table E-5	7970B Mag Tape	13181A Mag Tape Interface	12970A	Absolute Binary
	7970E Mag Tape	13183A Mag Tape Interface	12972A	Absolute Binary

7900/7901 Disc Loader

This disc loader loads a program from an HP 7900 or HP 7901 into memory. Starting at the beginning of cylinder 0, it is used to load from the selected surface of disc drive 0 a block of 128 (decimal) words into memory starting at location 2011 (octal). It then jumps indirect to a subroutine via memory address 2055 (octal) to execute the program just loaded from the disc. This program can be a boot loader which loads the Configurator after RUN is pressed. If the load is not successful, the result is unpredictable and the disc loader may have to be reloaded if a second load execution is desired. Before execution, the S-Register must be set to 10 (octal). Table E-2 lists the loading and execution procedure.

7905/7920 Disc Loader

This disc loader loads a program from an HP 7905 or an HP 7920 into memory. Starting at the beginning of cylinder 0, it is used to load from the selected surface of disc drive 0 a block of 128 words into memory starting at location 2011 (octal). It then jumps indirect to a subroutine via memory address 2055 (octal) to execute the program just loaded from the disc. This program can be a boot loader which loads the Configurator after RUN is pressed. If the load is not successful, the result is unpredictable and the disc loader may have to be reloaded if a second load execution is desired. Before execution, the S-Register must be set to 10 (octal). Table E-3 lists the loading and execution procedure.

2644/45 Minicartridge Tape Loader

This loader is used to load the Configurator stored on an HP 2644/45 cartridge tape via an HP 12966A Buffered Asynchronous Interface or an HP 12968A Asynchronous Interface into memory. The operator must select via the console the unit and file number prior to starting the loader. (Refer to HP 2644A Mini Data Station Owner's Manual, part no. 02644-90001, or to the HP 2645A Display Station User's Manual, part no. 02645-90001). There are no S-Register settings required. Table E-4 lists the loading and execution procedure.

7970B/7970E Magnetic Tape Loader

This loader is used to load the Configurator from 9-track magnetic tape (unit 0) into memory. Due to the fact that this loader does not have file selection capabilities, it is the responsibility of the operator to ensure that the next file to be read is the Configurator. There are no S-Register settings required. Table E-5 lists the loading and execution procedure.

Table E-2. HP 7900/7901 Disc Boot Loader

```
0001                ASMB,A,B,L,C
0003  07700               ORG 7700B
0004*
0005*
0006****  7900 DISC BOOT LOADER  ****
0007*
0008*
0009*     LOAD THE ENTIRE PROGRAM INTO THE LAST 64 LOCATION OF
0010*     ANY ONE PAGE IN BASE MEMORY WITH THE CORRECT SC'S FOR
0011*     THE DATA (DC) AND CONTROL (CC) CHANNELS.  BRING THE
0012*     P-REGISTER TO THE STARTING ADDRESS OF THE PROGRAM,
0013*     SET S-REGISTER TO 10 (OCTAL), PRESS PRESET (INT.
0014*     AND EXT.) AND RUN.
0015*
0016*
0017*     SEEK CYLINDER 0, UPPER/LOWER PLATTER, SECTOR 0
0018*
0019  07700 067741  START  LDB SEEKC     GET SEEK COMMAND WORD
0020  07701 10660          OTB DC     <- USE WORD FOR ADDRESS 0
0021  07702 103700         STC DC,C   <-   AND OUTPUT TO DATA CHANNEL
0022  07703 106601         OTB CC     <- OUTPUT SEEK COMMAND
0023  07704 103701         STC DC,C   <-   AND START SEEK
0024  07705 102300         SFS DC     <- HAS CYL. ADDRESS BEEN ACCEPTED?
0025  07706 027705         JMP *-1          NO
0026  07707 002400         CLA              SPECIFY HEAD 0 AND SECTOR 0
0027  07710 102600         OTA DC     <-   AND OUTPUT TO DATA CHANNEL
0028  07711 103700         STC DC,C   <-
0029  07712 102301         SFS CC     <- IS SEEK OPERATION COMPLETED?
0030  07713 027712         JMP *-1          NO
0031*
0032*     DMA INITIALIZATION
0033*
0034  07714 067735         LDB DMACW        GET DMA CONTROL WORD
0035  07715 106606         OTB 6            ISSUE DMA CONTROL WORD
0036  07716 067736         LDB ADDR1        GET MEMORY ADDR AND SPECIFY INPUT
0037  07717 106602         OTB 2            ISSUE MEMORY ADDR
0038  07720 102702         STC 2            SELECT WORD COUNT
0039  07721 067740         LDB CNT          GET WORD COUNT
0040  07722 106602         OTB 2            ISSUE WORD COUNT
0041*
0042*     7900 READ ROUTINE
0043*
0044  07723 106700         CLC DC     <- PREPARE CNTRLLER FOR READ COMMAND
0045  07724 106701         CLC CC     <-
0046  07725 063742         LDA READ C       GET READ COMMAND WORD
0047  07726 103601         OTA CC,C   <-   AND OUTPUT COMMAND
0048  07727 103700         STC DC,C   <- PREPARE DATA CHAN FOR READ OPER
```

Table E-2. HP 7900/7901 Disc Boot Loader (Cont.)

```
0049  07730 103706         STC 6,C        START DMA TRANSFER
0050  07731 103701         STC CC,C       INITIATE READ OPERATION
0051  07732 102301         SFS CC         CHECK FOR TRANSFER FINISHED
0052  07733 027732         JMP *-1
0053  07734 117737  EXIT   JSB ADDR 2,I   EXIT TO BOOT LOADER
0054*
0055*     CONSTANTS
0056*
0057  07735 120000  DMACW  ABS 120000B+DC ←SC OF CHAN (BITS 15 & 13 SET)
0058  07736 102011  ADDR1  OCT 102011
0059  07737 102055  ADDR2  OCT 102055
0060  07740 177600  CNT    DEC -128
0061  07741 030000  SEEKC  OCT 030000     SEEK COMMAND WORD
0062  07742 020000  READC  OCT 020000     READ COMMAND WORD
0063*
0064  00000         DC     EQU OB
0065  00001         CC     EQU DC+1
0066                       END
**  NO ERRORS *TOTAL **RTE ASMB 750420**
```

Table E-3. HP 7905/20 Disc Boot Loader

```
0001                    ASMB,A,B,L,C
0003  07700                    ORG 7700B
0004*
0005*
0006****  7905 DISC BOOT LOADER  ****
0007*
0008*
0009*     LOAD THE ENTIRE PROGRAM INTO THE LAST 64 LOCATION OF
0010*     ANY ONE PAGE IN BASE MEMORY WITH THE CORRECT SC FOR
0011*     THE DISC CHANNEL.  BRING THE P-REGISTER TO THE STARTING
0012*     ADDRESS OF THE PROGRAM, SET S-REGISTER TO 10 (OCTAL),
0013*     PRESS PRESET (INT. AND EXT.) AND RUN.
0014*
0015*
0016*     DMA INITIALIZATION
0017*
0018* 07700 067716  START  LDB DMACW   GET DMA CONTROL WORD
0019  07701 106606         OTB 6       ISSUE DMA CONTROL WORD
0020  07702 067717         LDB ADDR1   GET MEMORY ADDR AND SPECIFY INPUT
0021  07703 106602         OTB 2       ISSUE MEMORY ADDR
0022  07704 102702         STC 2       SELECT WORD COUNT
0023  07705 067721         LDB CNT     GET WORD COUNT
0024  07706 106602         OTB 2       ISSUE WORD COUNT
0025*
0026*     7905 COLD LOAD ROUTINE
0027*
0028  07707 106700         CLC SC  <-- PREPARE CONTROLLER FOR COMMAND
0029  07710 002400         CLA         CREATE COLD LOAD READ,HEAD 0,SECT 0
0030  07711 103600         OTA SC,C<-- OUTPUT COLD LOAD COMMAND
0031  07712 103706         STC 6,C     START DMA TRANSFER
0032  07713 102300         SFS SC  <-- CHECK FOR TRANSFER FINISHED
0033  07714 027713         JMP *-1
0034  07715 117720  EXIT   JSB ADDR2,I EXIT TO BOOT LOADER
0035*
0036*     CONSTANTS
0037*
0038  07716 000000  DMACW  ABS SC  <-- SC OF CHANNEL (BITS 15&13 CLEARED)
0039  07717 102011  ADDR1  OCT 102011
0040  07720 102055  ADDR2  OCT 102055
0041  07721 177600  CNT    DEC -128
0042*
0043  00000         SC     EQU OB
0044                       END
**  NO ERRORS *TOTAL **RTE ASMB 750420**
```

Table E-4. HP 2644/45 Minicartridge Tape Binary Loader

```
0001
0003  07700
0004*
0005*
0006****  2644/45 CARTRIDGE TAPE ABSOLUTE BINARY LOADER
0007*
0008*
0009*     LOAD THE ENTIRE PROGRAM INTO THE LAST 64 LOCATION OF
0010*     ANY ONE PAGE IN BASE MEMORY WITH THE CORRECT SC FOR
0011*     THE CHANNEL.  BRING THE P-REGISTER TO THE STARTING
0012*     ADDRESS OF THE PROGRAM, PRESS PRESET (INT. AND EXT.)
0013*     AND RUN.
0014*     THIS ASSUMES THE INTERFACE IS A 12966 OR 12968.
0015*     THE BAUD RATE IS EXTERNAL.
0016*     THE CARTRIDGE IS POSITIONED AT THE FILE TO BE READ
0017*     "RUN" CAN NOT BE PRESSED AFTER HALT 77B OR HALT 11B.
0018*
0019*
0020  07700 063773  START LDA LDOTP     RESET POINTER
0021  07701 073702        STA *+1
0022  07702 063763  NCW   LDA OTP       GET A WORD FROM THE TABLE
0023  07703 037702        ISZ *-1       MOVE TO NEXT WORD IN TABLE
0024  07704 103600        OTA SC,C <--  OUTPUT CURRENT WORD
0025  07705 053771        CPA EOT       END OF TABLE?
0026  07706 027717          JMP NRD       YES - START INPUT
0027  07707 001727        ALF,ALF       IS THIS A CHARACTER?
0028  07710 013772        AND .377
0029  07711 002002        SZA           ?
0030  07712 027702        JMP NCW       NO - DO NEXT CONTROL WORD
0031  07713 103700        STC SC,C <--  PUT CARD IN DATA MODE
0032  07714 102300        SFS SC   <--  IS CHARACTER OUT?
0033  07715 027714        JMP *-1       NO - WAIT FOR IT
0034  07716 027702        JMP NCW       YES - DO NEXT CONTROL WORD
0035  07717 017750  NRD   JSB INPUT     READ IN FIRST WORD (RECORD COUNT)
0036  07720 005727        BLF,BLF       POSITION COUNT TO LOWER BYTE
0037  07721 007007        CMB,INB,SZB,RSS  MAKE IT NEG AND IS IT EOF?
0038  07722 102077        HLT 77B       YES - END-OF-FILE
0039  07723 006021        SSB,RSS       IF COUNT WAS ALL ONES
0040  07724 102000        HLT 0         THEN TAPE ERROR
0041  07725 077776        STB WCT       SAVE COUNT
0042  07726 017750        JSB INPUT     READ STORE ADDRESS
0043  07727 077774        STB CKSUM     START CHECKSUM
0044  07730 077775        STB ADD         AND SAVE ADDRESS
0045  07731 017750  NWD   JSB INPUT     GET WORD TO BE STORED
0046  07732 063775        LDA ADD       CHECK IF ADDRESS
0047  07733 043777        ADA MXAD        IS ABOVE LOADER
0048  07734 002040        SEZ           IS IT?
0049  07735 102055        HLT 55B       YES
```

Table E-4. HP 2644/45 Minicartridge Tape Binary Loader (Cont.)

```
0050  07736 177775        STB ADD,I    NO - PUT WORD IN MEMORY
0051  07737 047774        ADB CKSUM    ADD IT TO CHECKSUM
0052  07740 077774        STB CKSUM
0053  07741 037775        ISZ ADD      MOVE ADDRESS UP ONE
0054  07742 037776        ISZ WCT      FINISHED WITH THIS RECORD?
0055  07743 027731        JMP NWD      NO - READ NEXT WORD
0057  07744 017750        JSB INPUT    YES - READ CHECKSUM
0058  07745 057774        CPB CKSUM    IS CHECKSUM OK?
0059  07746 027717        JMP NRD      YES - READ NEXT RECORD
0060  07747 102011        HLT 11B      NO
0061  07750 000000  INPUT NOP          INPUT ONE WORD FROM INTERFACE
0062  07751 006700        CLB,CCE      ZERO WORD AND START WITH UPPER HALF
0063  07752 102500        LIA SC  <--  GET DATA
0064  0775  002021        SSa,RSS      IS IT VALID DATA?
0065  07754 027752        JMP *-2      NO
0066  07755 013772        AND .377     YES - ELIMINATE UPPER HALF
0067  07756 044000        ADB A        ADD DATA TO B REG.
0068  07757 002041        SEZ,RSS      SECOND HALF READ?
0069  07760 127750        JMP INPUT,I  YES - RETURN WITH WORD IN B REG.
0070  07761 005767        BLF,CLE,BLF  NO - MOVE BYTE TO UPPER HALF
0071  07762 027752        JMP INPUT+2  SET LOWER HALF FLAG AND READ IT
0072*
0073  07763 150077  OTP   OCT 150077   MASTER RESET
0074  07764 040740        OCT 40740    INTERFACE CONTROL
0075  07765 030003        OCT 30003    CHAR FRAME CONTROL
0076  07766 000033  CHR1  OCT 33       ASCII "ESC"
0077  07767 050077        OCT 50077    RESET BUFFER STATUS
0078  07770 000145  CHR2  OCT 145      ASCII LOWER CASE "E"
0079  07771 040340  EOT   OCT 40340    INPUT COMMAND WORD
0080*
0081  07772 000377  .377  OCT 377      UPPER HALF WORD MASK
0082  07773 063763  LDOTP LDA OTP      POINTER TO OUTPUT TABLE
0083  07774 000000  CKSUM NOP          CHECKSUM STORAGE
0084  07775 000000  ADD   NOP          ADDRESS STORAGE
0085  07776 000000  WCT   NOP          INPUT WORD COUNT
0086  07777 170100  MXAD  ABS -START   START BINARY LOADER AREA
0087*
0088  00000         SC    EQU OB
0089  00000         A     EQU OB
0090  00001         B     EQU 1B
0091                      END
**  NO ERRORS *TOTAL **RTE ASMB 750420**
```

Table E-5. HP 7970B/7970E Magnetic Tape Binary Loader

```
0001                ASMB,A,B,L     MAG TAPE LOADER
0003  07700                ORG 7700B
0004*
0005*
0006****  7970 MAG TAPE ABSOLUTE BINARY LOADER
0007*
0008*
0009*     LOAD THE ENTIRE PROGRAM INTO THE LAST 64 LOCATION OF
0010*     ANY ONE PAGE IN BASE MEMORY WITH THE CORRECT SC'S FOR
0011*     THE DATA (DC) AND CONTROL (CC) CHANNELS.  BRING THE
0012*     P-REGISTER TO THE STARTING ADDRESS OF THE PROGRAM,
0013*     PRESS PRESET (INT. AND EXT.) AND RUN.
0014*
0015*
0016  07700 067753  START LDB RDCMD     GET READ COMMAND
0017  07701 106601        OTB CC    <-- OUTPUT COMMAND
0018  07702 102501        LIA CC    <-- CHECK IF REJECTED
0019  07703 001323        RAR,RAR
0020  07704 001310        RAR,SLA       ??
0021  07705 027701        JMP *-4       YES, TRY AGAIN
0022  07706 103701        STC CC,C  <-- NO, START COMMAND
0023  07707 103700        STC DC,C  <-- START DATA CHANNEL
0024  07710 102201  WFST  SFC CC    <-- CHECK FOR STATUS
0025  07711 027743        JMP STAT      YES
0026  07712 102300        SFS DC    <-- ANY DATA
0027  07713 027710        JMP *-3       NO
0028  07714 107500        LIB DC,C  <-- YES GET IT (RECORD COUNT)
0029  07715 005727        BLF,BLF       POSITION COUNT TO LOWER BYTE
0030  07716 007000        CMB           MAKE IT NEGATIVE
0031  07717 077755        STB WCT       SAVE INPUT COUNT
0032  07720 102201        SFC CC    <-- CHECK FOR STATUS
0033  07721 027743        JMP STAT      YES EXIT TO STATUS
0034  07722 102300        SFS DC    <-- WAIT TO READ NEXT WORD
0035  07723 027720        JMP *-3
0036  07724 107500        LIB DC,C  <-- GET LOAD ADDRESS
0037  07725 074000        STB 0         START CHECKSUM
0038  07726 077756        STB CMB         AND ADDRESS POINTER
0039  07727 027733        JMP *+4
0040  07730 177756  NWD   STB CMD,I     PUT WORD IN MEMORY
0041  07731 040001        ADA 1         ADD IT TO CHECK SUM
0042  07732 037756        ISZ CMD       MOVE UP ADDRESS
0043  07733 102300        SFS DC    <-- WAIT FOR NEXT WORD
0044  07734 027733        JMP *-1
0045  07735 107500        LIB DC,C  <-- GET DATA TO STORE IN MEMORY
0046  07736 037755        ISZ WCT       FINISHED WITH DATA?
0047  07737 027730        JMP NWD       NO READ NEXT WORD
0048  07740 054000        CPB 0         IS CHECKSUM OK?
0049  07741 027710        JMP WFST      YES - WAIT FOR COMMAND CHAN STATUS
```

Table E-5. HP 7970B/7970E Magnetic Tape Binary Loader (Cont.)

```
0050  07742 102011        HLT 11B       NO
0052  07743 102501  STAT  LIA CC        GET STATUS
0053  07744 001727        ALF,ALF       POSITION EOF BIT
0054  07745 002020        SSA           IS IT EOF?
0055  07746 102077        HLT 77B       YES
0056  07747 001727        ALF,ALF       REPOSITION STATUS
0057  07750 001310        RAR,SLA       YES READ OK?
0058  07751 102000        HLT 0         NO TELL OPERATOR
0059  07752 027700        JMP START     YES READ NEXT RECORD
0060*
0061*
0062  07753 001423  RDCMD OCT 1423      MT READ A RECORD COMMAND
0063  07754 000203  FFC   OCT 203       MT FILE FORWARD COMMAND
0064  07755 000000  WCT   NOP           INPUT WORD COUNT
0065  07756 000000  CMD   NOP
0066*
0067  00000         DC    EQU OB
0068  00001         CC    EQU DC+1
0069                      END
**  NO ERRORS *TOTAL **RTE ASMB 750420**
```

Table E-6. HP 12992J 7908/7911/7912/7914/7933 CS/80 Disc Loader ROM

```
00001
00002*************************************************************************
00003*   CS80 BOOT LOADER       RPL COMPATIBLE       810915          *
00004*                                                               *
00005*                                                               *
00006*     PRODUCT NUMBER 12292J                                     *
00007*     PART NUMBER    12992-80005                                *
00008*                                                               *
00009*                                                               *
00010*     S REG                                                     *
00011*       15 - 14 BOOT ROM                                        *
00012*       11 - 6  IBI SELECT CODE                                 *
00013*        2 - 0  UNIT                                            *
00014*************************************************************************
00015*
00016  07700                 ORG 7700B
00017        000010  IBI      EQU 10B
00018  07700 102501  START    LIA 1          GET SWITCH REGISTER
00019  07701 013751           AND XXX        AND OUT UNIT
00020  07702 033742           IOR UNIT       PUT IN UNIT COMMAND
00021  07703 073742           STA UNIT       SAVE FOR BUS
00022  07704 000040           CLE
00023*
00024*   WAIT FOR DRIVE 0 READY
00025*
00026  07705 017756           JSB BTCTL      SEND UDC,PPOL
00027  07706 102510           LIA IBI        READ INPUT REGISTER
00028  07707 101027           ASR 7          SHIFT DRIVE 0 RESPONSE TO LSB
00029  07710 002011           SLA,RSS        DID DRIVE 0 RESPOND
00030  07711 027706           JMP *-3        NO GO WAIT
00031*
00032  07712 107700           CLC 0,C        SHUT DOWN EVERYONE ELSE
00033  07713 017756           JSB BTCTL      SEND TALK,READ,BUS HOLDER
00034  07714 002300           CCE
00035  07715 017756           JSB BTCTL      TELL CARD TO LISTEN
00036*
00037*   PERFORM DMA TRANSFER
00038*
00039  07716 063776           LDA DMACW      LOAD DMA CONTROL WORD
00040  07717 102606           OTA 6          OUTPUT TO DCPC
00041  07720 106702           CLC 2          READY DCPC
00042  07721 063733           LDA ADDR1      LOAD DMA BUFFER ADDRESS
00043  07722 102602           OTA 2          OUTPUT TO DCPC
00044  07723 063736           LDA DMAWC      LOAD DMA WORD COUNT
00045  07724 102702           STC 2          READY DCPC
00046  07725 102602           OTA 2          OUTPUT TO DCPC
00047  07726 103706           STC 6,C        START DCPC
00048  07727 102206  TEST     SFC 6          SKIP IF DMA NOT DONE
```

Table E-6. HP 12992J 7908/7911/7912/7914/7933 CS/80 DISC LOADER ROM (Cont.)

```
00049  07730 117747          JSB ADDR2,I  SUCCESSFUL END OF TRANSFER
00050  07731 102310          SFS IBI      SKIP IF DISC ABORTED TRANSFER
00051  07732 027727          JMP TEST     WAIT...WAIT...WAIT
00052  07733 102011  ADDR1   HLT 11B      ERROR HALT
00054*
00055*   PROGRAM CONSTANT TABLE
00056*
00057  07734 000677  UNCLR   OCT 677      UNLISTEN
00058  07735 000737          OCT 737      UNTALK
00059  07736 176624  DMAWC   OCT 176624   UNIVERSAL CLEAR,LBO/DMA WORD CNT
00060  07737 000624          OCT 624      SECOND UNIVERSAL CLEAR
00061  07740 000440  LIST    OCT 440      LISTEN BUS ADDRESS 0
00062  07741 000745  CMSEC   OCT 745      COMMAND MESSAGE
00063  07742 000040  UNIT    OCT 40       UNIT
00064  07743 001000  READ    OCT 1000     READ
00065  07744 000677  UNLST   OCT 677      UNLISTEN
00066  07745 000500  TALK    OCT 500      DEVICE TALK
00067  07746 100556  EXEC    OCT 100556   EXECUTION MESSAGE
00068  07747 102055  ADDR2   OCT 102055   BOOT EXTENSION STARTING ADDRESS
00069  07750 004003  CTLP    OCT 4003     INT=LBO,T,CIC
00070  07751 000047  XXXX    OCT 47       PPE,L,T,CIC
00071  07752 004003          OCT 4003     INT=LBO,T,CIC
00072  07753 000413          OCT 413      ATN,PL,L,CIC
00073  07754 001015          OCT 1015     INT=EOI,P,L,CIC
00074  07755 000000          NOP
00075*
00076*
00077*
00078  07756 000000  BTCTL   NOP
00079  07757 107710          CLC IBI,C    RESET IBI
00080  07760 063750  BM      LDA CTLP     LOAD CONTROL WORD
00081  07761 102610          OTA IBI      OUTPUT TO IBI
00082  07762 102710          STC IBI      RETURN IBI TO DATA MODE
00083  07763 037760          ISZ BM       INCREMENT CONTROL WORD POINTER
00084  07764 002240          SEZ,CME
00085  07765 127756          JMP BTCTL,I  RETURN
00086  07766 063734  LABL    LDA UNCLR    LOAD DATA WORD
00087  07767 03766           ISZ LABL     INCREMENT WORD POINTER
00088  07770 102610          OTA IBI      OUTPUT TO HPIB
00089  07771 002021          SSA,RSS      SKIP IF LAST WORD
00090  07772 027766          JMP LABL     GO BACK FOR NEXT WORD
00091  07773 102310          SFS IBI      SKIP IF LAST WORD SENT TO BUS
00092  07774 027773          JMP *-1      WAIT FOR ACCEPTANCE
00093  07775 027757          JMP BTCTL+1
00094  07776 000010  DMACW   ABS IBI
00095  07777 170100          ABS -START
00096                        END
MACRO:   No errors total
```

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Reference Manual

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